LEHIGH RIVER BASIN

POHOPOCO CREEK, PENNSYLVANIA

BELTZVILLE LAKE

CONDITION REPORT

DAM, OUTLET WORKS & SPILLWAY

PERIODIC INSPECTION REPORT NO.6

NOVEMBER 1976

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

JULY 1977

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1. REPORT NUMBER: COE/NAD/BL/PIS/no.6/11-76	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): Beltzville Lake, Lehigh River Basin, Pohopoco Creek, Penna. Sylvania Condition Report. Dam outlet works and spillway. Periodic inspection report no. 6	5. TYPE OF REPORT & PERIOD COVERED: Periodic inspection report no. 6 Nov. 1976 for period ending Nov 76.
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Beltzville Lake Dam, Pa.	Structural analysis
Pohopoco Creek, Pa.	Spillways
Dam Inspection	Outlet works
Dam Safety	Lehigh River Basin

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The sixth periodic inspection of Beltzville Lake Dam was held on 11 and 12 Nov. 1976 by representatives of the North Atlantic Division and the Philadelphia District Army Corps of Engineers. The overall condition of the project is considered good. The two items of most concern to the inspection party were (1) the deterioration of the motor control units in the tower and (2) the loss or faulty operations, since the dam's construction of a total of eight piezometers of the Warlam type, all of which are located downstream of the

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dam centerline (two of this total have been inoperative since October 1974). The motor control units have been replaced and action is in progress to correct other deficiencies prior to Obtober 1977.

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★ U.S. GPO: 1974—540-847/9052

NADEN-TF (6 Jul 77) 1st Ind
SUBJECT: Beltzville Lake, Periodic Inspection Report Number 6

DA, North Atlantic Division, Corps of Engineers, 90 Church Street,
New York, NY 10007 8 August 1977

TO: District Engineer, Philadelphia ATTN: NAPEN-F

The report is approved, subject to implementation of the following comments:

a. Paragraph 1-03. The interval of periodic inspection should not be greater than 3 years because of the reported embankment - foundation seepage.

b. Section 2-06 f. At the time of the periodic inspection (Nov 76) the District advised that a contract for repairs to the Stilling Basin in the estimated amount of $65,000 was being prepared. The status of this work, now noted as not having been repaired, should be definitively stated. It should be indicated in Section 6 if it has a high priority.

c. Section 5. It should be noted that the replacement of the environmental quality control system will result in a revision to Section 2-4.11 of the O&M manual. Other findings and recommendations of periodic inspections resulting in modifications of operations and maintenance procedures should likewise note the appropriate revisions to the O&M manual.

FOR THE DIVISION ENGINEER:

1 Incl (trip)
wd 3 cys

F. R. PAGANO
Chief, Engineering Division

CF: w/incl
HQDA (DAEN-CWE-B), Washington, D. C. 20314

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO

NAPEN-F

6 July 1977

SUBJECT: Beltzville Lake, Periodic Inspection Report Number 6

Division Engineer, North Atlantic
ATTN: NADEN

In accordance with the instructions contained in ER 1110-2-100, "Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures," the subject report is transmitted for your review and approval.

FOR THE DISTRICT ENGINEER:

Worth D. Phillips

WORTH D. PHILLIPS
Chief, Engineering Division

1 Incl (6 cys)
as

INSPECTION & ACTION SUMMARY
PERIODIC INSPECTION REPORT NO.6

Item	Summary of Comment(s)	Action
1. Abutment & embankment junctions.	Erosion noted at downstream and upstream contacts of embankment with right abutment. Boulders placed on downstream junction during construction to reduce erosion have been only partially effective. Condition noted in Periodic Inspections 1, 2, 3, 4, 5, & 6.	Dam operating personnel have filled and regraded the upstream contact area to provide drainage away from riprap toe. Plans for correction of the erosion of the downstream contact on the right abutment are being prepared by Engineering Division
2. Sloughing or erosion of embankment slopes.	Resistance of material on downstream slopes to weathering & possible eventual clogging of horizontal drain with migrating fines was questioned during Periodic Inspection #1; minor erosion paths in downstream slope were noted during Periodic Inspection No. 2; no problems noted during Periodic Inspections 3 & 4. No problems noted in Periodic Inspections Nos. 5 and 6 except for slight erosion of the lower portion of upstream right abutment slope.	Slope have been closely observed for sloughing and erosion by operating personnel. Piezometers indicate no pressure increases attributable to ineffectiveness of horizontal drain. Gradation of drain should preclude infiltration. Project personnel have installed gutter in lower portion of upstream right abutment slope to control erosion & it is effective.

3. Spillway - Weepholes and drainage system.	Some weepholes in spillway slab clogged with dirt and needed cleaning (Periodic Inspection No. 1): installation of screens to prevent clogging & entry of burrowing animals recommended (Periodic Inspections 1, 2, & 3). During Periodic Inspection No. 5 a few spillway slab protective screens were missing or displaced from outlets. The concrete lined ditch on top of the slope on the right side of the spillway had areas where the slab had cracked, areas beneath the slab had eroded and some slabs had been displaced. During periodic inspection No. 6, one drain on the downstream, left side of the spillway appeared to be clogged.	Screens were installed following third periodic inspection. Protective screens have been replaced and realignment of slabs, backfilling of eroded areas beneath slab with lean concrete, and sealing of cracks with asphaltic or tar sealer was recommended (Periodic Inspection No. 5) and repairs were completed by operating personnel. Cleaning of drain was recommended (Periodic Inspection No. 6).
4. Outlet Works Conduit concrete surfaces and cracks.	Minor cracking in transition zone, conduit and tower sections noted in Periodic Inspections 1 & 2, crack survey and updating recommended. Minor spalling noted in Periodic Inspections 2, 3, 4 & 5. New hairline cracking, extensions of cracking mapped in 1971, was noted in Periodic Inspection No. 6.	Crack survey was made following Periodic Inspection No. 1 and updated after Periodic Inspection No. 2. No further action planned at this time.
5. Seepage Condition (Embankment and/or foundation).	Small springs noted along left abutment downstream of dam (Periodic Inspection No. 2): seeps in rock cut to right of stilling basin had begun during preceding winter & continued throughout the summer, base flow of seepage along left abutment had increased during filling of the reservoir (Periodic Inspection No. 3). Installation and monitoring of weir system (Inspections 2 & 3) and seepage study (Periodic Inspection No. 3) recommended. The right abutment weir was not operational at Periodic Inspection No. 5.	Weirs installed, maintained and monitored, which show a stabilized discharge after reaching full pool. Evaluation of seepage condition submitted (Para 8, Periodic Inspection Report No. 3 and 4) with conclusion that the small controlled discharge does not represent any problems. Monitoring of weirs by operating personnel will continue on current schedule. Repair of the right abutment weir made by project personnel.

6. Outlet Works - Joints and joint material.	Leakage noted at construction joints Sta's 2+53.59 (Periodic Inspection No. 2) and 11+53.59 (Periodic Inspections 2,3 & 4). Minor spalling at construction joints noted during all inspections. Spalls appear to be result of patch failures. During Periodic Inspection No. 5 the leakage at Sta. 11+53.59 was slightly more than previously observed and spalls appeared to have increased in number due to loss of patching materials. Leakage at Sta. 11+53.59 had decreased since the last inspection (Periodic Inspection No. 6) and several new or enlarged spalls were noted.	Joints will be monitored by Periodic Inspection Teams, no further action recommended at this time.
7. Outlet Works - Water passages including drains.	Replacement of missing pressure cell cover plate recommended (Periodic Inspection Nos. 2 & 3). A stream of cloudy water coming from the second weephole on the right side of the stilling basin was noted during Periodic Inspection No. 5. No cloudy water was noted during the 6th Periodic Inspection.	Pressure cell cover replaced in spring 1973. No further action recommended at this time.
8. Spillway - Concrete surfaces	Hairline cracking and poor surface appearance noted (Periodic Inspection No. 1); no changes in appearance or condition noted in Periodic Inspection Nos. 2, 3, & 4 except for some new spalling in center slabs upstream of bridge piers (Periodic Inspection No. 3). Cracks were noted on the sides of right abutment wingwalls (Periodic Inspection No. 5). No change in appearance or condition noted in Periodic Inspection No. 6.	Crack survey completed following Periodic Inspection No. 2. Cracks on sides of right abutment wingwalls do not require any repair (Periodic Inspection No. 5). No further action recommended at this time.
9. Spillway - Joint displacement and joint material.	Extrusion of pre-molded joint material along the left side of the north spillway bridge pier due to closure of joint (Periodic Inspection Nos. 1, 2, 3 & 4). Joint space on right side of pier has opened to extent that joint material does not cover joint (Periodic Inspection Nos. 4 & 5). Sealant in joints in poor condition or gone (Periodic Inspection No. 6).	North bridge pier was monumented to determine if joint action is the result of pier movement. Cleaning of joints and replacement of sealant recommended.

10.	Miscellaneous - Fencing.	Fencing located at tower bridge abutment, designed to prevent entrance by unauthorized personnel, is inadequate (Periodic Inspection No. 2).	Security fencing was modified to prohibit access by unauthorized personnel following Periodic Inspection No. 2.
11.	Miscellaneous - Saw Mill Run erosion ditch.	A ditch running from the downstream toe to Saw Mill Run had been badly eroded. Steep banks, 20 to 25 feet high with overhanging trees, presented a safety hazard to the Public (Periodic Inspection Report No. 2).	Work on a drainage pipe commenced following Periodic Inspection No. 2 and was completed and performing satisfactorily prior to Periodic Inspection No. 4.
12.	Miscellaneous - Access Road entrance speed reduction.	Because of combination of vertical and horizontal curves on the relocated highway in the vicinity of the entrance to the public overlook area, sight distances were considered marginal. Recommendation to approach state highway officials to consider reduction of speed limit in this area of the public highway (Periodic Inspection No. 2).	No formal action taken. No complaints from public or accidents have been reported to the District.
13.	Intake Tower - Structural	Minor leakage noted, hairline cracks in penthouse roof slab noted & corrosion of imbedded connection plates supporting mezzanine framing noted. (Periodic Inspection No. 6).	Test Section using Vandex-type interior treatment for leakage & painting of connection plates recommended.
14.	Intake Tower Equipment - water quality control gates and hoists.	Gate does not close completely, having an opening of 0.4 inches in closed position (Periodic Inspection No. 3); Control gate leaks around stem seal at specific gate settings (Periodic Inspection No. 4). The control gate has slight leak in closed position, leakage less than noted in previous inspection (Periodic Inspection No. 5).	Control gate can be closed manually should the need arise for complete closure-no further action contemplated. Gate stem seal leak has been studied by District personnel and no action is required

15.	Intake Tower Equipment - Sluice gate and hoist.	Number 1 sluice gate had a bent stem and cracked casings and indicators were loose. Periodic Inspection No. 3). Number 1 main gate needs new seal retainer flange (Periodic Inspection No. 5). No. 8 gate has bent shaft and leaks noticeably when in closed position (Periodic Inspection No. 6)	Stem and casing repaired; adjustments made to prevent reoccurrence. Replacement of sluice gate No. 8 shaft and guide bearings recommended.
16.	Intake Tower Equipment - Elevator	Elevator was not operational at the time of Periodic Inspection No. 3. Primary causes of problem were shorts in the power cable and corrosion of relay contacts due to high humidity in the tower (Periodic Inspection No. 3). Wiring rearrangement needed (Periodic Inspection No. 5 & No. 6).	Permanent repairs completed after Periodic Inspection No. 3. Maintenance contractor keeping elevator in working order. Engineering Division will investigate and recommend changes to the wiring arrangement.
17.	Intake Tower Equipment - Electrical (general)	Water present in electrical conduits and boxes at lower elevations. Recommended surface mounting of boxes and repair of dead portable heater socket @ El. 548. (Periodic Inspection No. 3). Most work completed with exception of a few receptacles still to be reset (Periodic Inspection No. 4) Dehumidifier system was not in operation due to backup of water into the equipment (Periodic Inspection No. 5) Electrical wiring and conduit have deteriorated: motor control centers for hydraulic system need-replacement; lightning arrestors on electrical service needed. (Periodic Inspection No. 6).	District electrician has rewired lower tower elevations and provided for drainage of water in conduits. Repairs to the Dehumidifier system in October 1974. Motor control centers replaced early in 1977. Lightning arrestors and rewiring of tower being designed by Engineering Division.

18.	Intake Tower Environmental Quality Control Equipment	Environmental Quality Control System was down for repair of damages caused by shorting from an electrical storm (Periodic Inspection No. 5). The environmental quality control equipment was abandoned and removed due to its unreliability and high maintenance costs (Periodic Inspection No. 6).	A replacement system is currently being designed.
19.	Intake Tower Equipment - Heating (general)	Providing adequate heating in lower levels of the tower recognized as a problem, study of problem and initiation of corrective measures recommended. (Periodic Inspection No. 3). Heating of lower portion of tower still a problem (Periodic Inspection No. 6).	Study and redesign of system recommended by Periodic Inspection No. 6 team.
20.	Spillway - Bridge	Many nuts holding guard rail to bridge parapet were not tight against railing base. (Periodic Inspection No. 3). Expansion joints sealant gone, rust spots noted on lower flange of bridge girders. (Periodic Inspection No. 6).	Nuts tightened after Periodic Inspection No. 3. No action recommended for rust spots; cleaning of joints and replacement of sealant recommended.
21.	Spillway - Side slopes	Erosion noted along right side of spillway cut upstream of chute (Periodic Inspection No. 3); extent of weathering of slope questioned. Continuation of weathering and slow flattening of upstream side slopes were noted in Periodic Inspection No. 5. Minor rock falls noted on right slope of spillway upstream of spillway bridge (Periodic Inspection No. 6).	Operating personnel corrected erosion problem by extending top of slope drainage ditch past eroding area. District will research construction files for photos and comparison with existing conditions will be made. Removal of rock debris and stockpiling in "fossil" area recommended.

22.	Recreation Area - Boat launching ramp.	State park managers and dam operating personnel reported a potentially dangerous situation. During first summer of operation, two cars rolled down the ramp into 10 to 15 feet of water when launching or landing boats. (Periodic Inspection No. 3).	Boat launching ramps are being swept clean of loose gravel which had apparently contributed to former problems. No further problems reported.
23.	Recreation Area	Half of the toilet facilities have been blocked off by the state personnel. The state personnel have inquired as to the possibility of constructing a pool which would back up water under the covered bridge (Periodic Inspection No. 5). Toilet facilities still blocked off, stacks on oil fired hot water heater knocked down during storm. (Periodic Inspection No. 6).	State park personnel were informed that toilet facilities should be opened but this was not done due to reductions in their staff. State was requested to supply a plan for the intended construction of a pool for review by the Philadelphia District before approval is given. Replacement of stacks, opening of toilet facilities recommended.
24.	Intake Tower Equipment - Emergency engine generator	Hydraulic starter for emergency engine generator is difficult to reprime when engine fails to start, requires 20 minutes to reprime using hand crank.	Recommended replacement of hydraulic starting system with electric starting system.

25.	Stilling basin - Outlet channel side slopes.	Outlet channel side slopes have suffered erosion on both banks due to extremely high releases during conduit gate rating and prototype testing in spring 1973. Most extensively eroded area is on right bank immediately downstream of stilling basin. Periodic Inspection Nos. 4, 5, & 6. Guard rail posts along the access road have been undermined at several locations due to this erosion (Periodic Inspection No. 5)).	Tentatively plan to restore eroded areas, however, condition is not serious. Undermined guard rail posts were repaired following Periodic Inspection No. 5.
26.	Embankment-Movement of structural features. Service bridge to tower.	Small northward horizontal movement recorded by tower bridge alignment survey. Present amount of movement presents no danger to structure. (Periodic Inspection Nos. 4 & 5. Expansion joints filled with dirt and joint sealant missing or in poor condition (Periodic Inspection No. 6).	District continuing observations on regular schedule. Recommend cleaning of joints and replacement of sealant. Lightning arrestors recommended for service bridge entrance.
27.	Spillway - Upstream wet area.	Wet area observed in upstream end of spillway; recommended drainage by shallow trenching if site conditions permit (Periodic Inspection No. 4). Wet areas in upstream and downstream areas. (Periodic inspection No. 6).	Recommend continuation of present practice of ditching as a maintenance procedure to provide drainage.
28.	Sewage Treatment Plant	The wire feeding the froth control pump is exposed (Periodic Inspection Nos. 5 & 6), painting of exposed equipment needed, wire left bear by removal of float switch on wet wall should be insulated. (Periodic Inspection No. 6)	Enclosing the wire in conduit; Insulation of wire & repainting of exposed equipment recommended. (State of PA responsibility).

CONDITION REPORT
BELTZVILLE LAKE
Pohopoco Creek, Pennsylvania

Periodic Inspection Report No. 6
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PLATES

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23	Vertical Deflection Data N&S VIF -92-2	1970-1971
24	Vertical Deflection Data N&S VIF -92-2	1972-1973
25	Vertical Deflection Data N&S VIF -92-2	1974-1975
26	Vertical Deflection Data N&S VIF -92-2	1976
27	Subsurface Settlement Data VIF -95-2	1969-1970
28	Subsurface Settlement Data VIF -95-2	1971-1972
29	Subsurface Settlement Data VIF -95-2	1973-1974
30	Subsurface Settlement Data VIF -95-2	1975-1976
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51	Top of Dam Settlement	1970-1971
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APPENDIX A
List of Attendees - Periodic Inspection No. 6

APPENDIX B
Photographs

APPENDIX C

NADEN-TF/TS D.F. dated 14 December 1976. Subject, Beltzville Dam, Periodic Inspection.

NAPNA D.F. and Inclosure dated 24 February 1977. Subject, Periodic Inspection, Beltzville State Park Facilities, 12 Nov 76.

BELTZVILLE LAKE
Pohopoco Creek, Pennsylvania
Dam, Outlet Works and Spillway
Periodic Inspection Report No. 6

SECTION 1
INTRODUCTION

1-01. AUTHORITY AND SCOPE. This report has been prepared in accordance with Engineer Regulation 1110-2-100 entitled "Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures".

This report presents the results of the sixth periodic inspection, instrumentation readings for their full recording period and remedial measures adopted by the District.

1-02. CONSTRUCTION HISTORY. The construction history of the dam site facilities and Phase I clearing contract to Elevation 586 were presented in Periodic Inspection Report No. 2. The Phase II clearing contract and recreation contract are described in Periodic Inspection Reports No. 3 and 4.

1-03. INSPECTION AND EVALUATION. As required by ER 1110-2-100 "Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures", a system of continuing evaluation including periodic inspection was planned to assure the safety and stability of the Beltzville Lake Project. These periodic inspections are planned to detect problem areas and to provide a basis for recommendations for remedial treatment if and when required. Periodic Inspections for Beltzville Lake have been performed or are tentatively scheduled in the following sequence:

Inspection	Time Interval	Scheduled Date	Actual Date
Initial		July 1970	20 July 70
2nd Periodic	1 year	July 1971	22 July 71
3rd Periodic	1 year	July 1972	14-15 Sep 72
4th Periodic	1 year	July 1973	23-24 Aug 73
5th Periodic	1 year	July 1974	16-17 Sep 74
6th Periodic	2 years*	July 1976	11-12 Nov 76
7th Periodic	2 years	July 1978	
8th Periodic	**	**	

* Originally scheduled for 1 year time interval. Changed to 2 year time as recommended by NAD inspection team following the 5th Periodic Inspection.

** Inspection following the two year interval will be increased to a five year frequency if justified by the results of previous inspections.

SECTION 2
SIXTH PERIODIC INSPECTION

2-01. GENERAL. The sixth periodic inspection was held on 11 and 12 November 1976 and was attended by representatives of North Atlantic Division and Philadelphia District. The list of those attending is included in Appendix A. Pool level at the time of inspection was at elevation 622.5 which is 7.5 feet below the normal pool elevation of 628 and is 120.5 feet above the normal pre-impoundment river elevation. The normal pool elevation was first reached on 18 December 1971. It had remained near this level (fluctuations ranged from 6 feet below to 9 feet above normal pool) until lowered as requested by the Park Superintendent to permit beach maintenance activities beginning 8 Nov 1976.

Upon arrival at the project site, the inspection party was briefed on the results of the previous periodic inspections. Copies of the third, fourth and fifth periodic inspection reports were available for use by the inspection team members. A review of the instrumentation data collected over their entire recording period was made prior to beginning the inspection and a detailed check list was supplied for use during the inspections. The party inspected the intake tower, conduit, stilling basin, embankment, abutment-embankment junctions and sewage treatment facilities on the first day of the inspection and the spillway, spillway bridge, roadway bridges and recreation areas during the morning of the second day.

Following the inspection, a critique was conducted in the project office. Comments made at the critique are summarized in the following subsections 2-02 through 2-11.

2-02. INSTRUMENTATION DATA. It was recommended that all instrumentation be read as scheduled, but piezometer and weir readings be submitted to the District office concurrently on a monthly basis. The non-functional piezometers should be replaced in the spring of 1977. Current and future inspection reports should include graphic plots of all instrumentation data accumulated to the reporting date in lieu of incremental data.

2-03. SERVICE BRIDGE.

a. Concrete Surfaces - No deficiencies noted.

b. Concrete Cracks - Minor cracking noted in the parapet wall and on top of piers - No repair required at this time.

c. Expansion Joints - Joints filled with dirt and sealant missing or in poor condition. Cleaning and replacement of sealant is recommended.

d. Drainage System - No deficiencies noted.

e. Structural Steel - Some rust spots on top of lower flanges of steel bridge - No repair required at this time.

f. Bearings - No deficiencies noted.

g. Guard Rails and Fencing - No deficiencies noted.

h. Bridge Movement - Normal

i. Lightning arrestors should be installed at service bridge entrance.

2-04. INTAKE TOWER.

a. Structural.

(1) Concrete Surfaces - No deficiencies noted.

(2) Concrete Cracks - Penthouse roof slab has hairline cracks at 1/3 points - No repair required at this time.

(3) Leakage - Minor leakage noted, no increase since previous inspections, some calcite buildup. Recommend Vandex type interior surface treatment on test section.

(4) Connection plates imbedded in concrete walls and supporting mezzanine framing are corroding. Recommend cleaning and repainting.

b. Equipment.

(1) Service Gates and Hoists - No deficiencies noted.

(2) Emergency Gates and Hoists - No deficiencies noted.

(3) Water Quality Control Gate and Hoist - No deficiencies noted.

(4) Sluice Gates and Hoists - No. 8 Gate has bent shaft and noticeable leakage occurs when gate is in closed position - Recommend replacement of shaft section and guide bearings with newly fabricated parts.

(5) Elevator - Still have problems with electrical system (see item #7).

(6) Sump Pumps and Bypass Drain - Noted broken grates and drain on the right side clogged - Recommend replacement of the grates and clearing the drain.

(7) Electrical - Electrical wiring and conduit have deteriorated - Recommend installation of surface mounted, stand off junction boxes and

equipment to replace embedded wiring devices; immediate replacement of motor control centers for hydraulic systems. If failure of the latter should occur, the hydraulic system for operation of the gates cannot be actuated except by employing extraordinary measures requiring the services of an electrician and/or electrical engineer. There are no lightning arrestors on electrical service. Recommend design and installation of lightning arrestor system for electrical service. Five navigation lights and three bridge lights are burned out. Recommend the relamping of these lights.

(8) Dehumidifier - Two coils are burned out and the dehumidifier is being operated as an auxiliary heat unit - Recommend replacement of coils and operating correctly as dehumidifier.

(9) Engine Generator (Emergency) - Hydraulic starter for emergency generator is difficult to reprime when engine fails to start, requiring approx. 20 minutes to reprime using hand crank. Recommend replacing hydraulic start system with electrical start.

(10) Heating and Ventilating System - Lack of adequate heating in lower levels of the tower noted during previous inspections is still a problem. Recommend study and redesign of system. Possible solutions include: (a) Relocate electric duct heater to lower level, (b) Relocate heat duct to right wall with outlets near floor at level #1, (c) Raise cold air return to near ceiling of level #2 and (d) Insulate gate vent pipes with at least 2" polyurethane foam with vapor barrier on outside.

2-05. CONDUIT.

a. Concrete Surfaces - No deficiencies noted.

b. Concrete Cracks - New hairline cracking noted. These are extensions of cracking mapped in 1971 and are not considered a threat to the structure.

c. Leakage - Leak through the joint near downstream end noted in previous inspections still flowing but flow has decreased since last inspection. No repairs considered necessary.

d. Joints - Spalling noted at most joints, large spall area (approx 1.5 sq. ft.) on right hand side of north chamber. No repairs needed at this time.

e. Drains - No deficiencies noted.

2-06. STILLING BASIN.

a. Concrete Surfaces - No appreciable change noted since last inspection;

some spalling and loss of material from middle of slab - No repairs needed.

b. Concrete Cracks - New hairline cracks noted at top center of walls, just downstream of bypass outlet. No repair required.

c. Leakage - None noted.

d. Joints - No deficiencies noted.

e. Drains (weepholes, etc) - No deficiencies noted.

f. Other - Eroded outlet channel sideslopes noted in the fourth periodic inspection have not been repaired. The undermined guardrail posts mentioned in Inspection Report No. 5 have been repaired.

2-07. EMBANKMENT:

a. Surface Cracks - None noted.

b. Abutment and Embankment Junctions - No problems noted.

c. Vertical and Horizontal Alignment - No problems noted.

d. Unusual Movement or Cracking at or Beyond Toe - None noted.

e. Unusual Through Embankment or Downstream Seepage - None noted. See paragraph 4-04 for weir measurements of normal seepage.

f. Sloughing or Erosion of Embankment or Abutment. No problems noted except some erosion along the toe of right abutment above stilling basin - Plans and Specifications are in development for improvements of surface drainage system in this area.

g. Movement of Structural Features in Embankment (Conduit and Intake Tower) - None noted.

h. Rip-rap Failure (Major Displacement) - None noted.

2-08. SPILLWAY.

a. Bridge.

(1) Concrete Surfaces - Generally good.

(2) Concrete Cracks - No new cracks noted; original cracks described in previous inspection reports have not extended or widened.

(3) Expansion Joints - Sealant gone - Recommend cleaning and replacing of sealant.

(4) Drainage system - No deficiencies noted.

(5) Structural Steel - Rust spots noted at top of lower flange - No action recommended.

(6) Bearings - Functioning properly.

(7) Guard Rails - No deficiencies noted.

(8) Bridge Movement - No evidence of movement noted.

b. Chute and Gravity Walls.

(1) Concrete Surfaces - No change since last inspection.

(2) Concrete Cracks - No change since last inspection.

(3) Expansion Joints - No change since last inspection - Recommend cleaning and resealing joints at right side and at bridge pier.

(4) Drainage System - One drain on downstream, left side appears to be clogged - Recommend cleaning.

(5) Leakage - Wetness due to poor drainage noted in upstream spillway channel and downstream spillway chute - Recommend continuation of present maintenance procedure of ditching to provide drainage.

c. Other.

(1) Spillway Side Slopes - Minor rock falls noted on right slope of spillway upstream of service bridge - Recommend removal of the rock debris and stockpiling in "fossil" area since the rock is highly fossiliferous.

2-09. DOWNSTREAM AREA.

a. Erosion and Drainage - As mentioned in 2-06.f. outlet channel sideslopes are eroded. Remedial measures consisting of riprap repair and extension are recommended after higher priority work is accomplished.

b. Surface Cracks - None noted.

c. Weirs - No deficiencies noted.

2-10. UPSTREAM RESERVOIR AREA.

a. Erosion of Reservoir Sideslopes - Slight erosion noted - No remedial treatment necessary.

b. Condition of the Highway Embankment Riprap - generally good.

c. Concrete Drainage Ditches - No problems noted.

d. Highway Bridges - No deficiencies noted.

2-11. MISCELLANEOUS - (Sewage Treatment Plant, Dam Operators' Houses and Recreation Areas).

a. Recreation Area Boat Launch - Add lightning arrestor for public safety.

b. Maintenance - A list of normal maintenance - repair items noted during the inspection was furnished to the Northern Area Engineer.

SECTION 3
CORRECTIVE MEASURES

3-01. FIFTH PERIODIC INSPECTION. Corrective measures to alleviate problem areas noted during the fifth periodic inspection are listed in the following subparagraphs. Page numbers refer to the report of that inspection.

a. Page 3. Leakage (Interior of intake tower) - "First landing up from operating floor was wet due to calcite buildup filling space between stairway and wall and preventing drainage through that space. Dam personnel will clean out space to allow drainage. Calcite buildup on walls continuing."

Dam operating personnel removed calcite buildup between stairway and wall.

b. Page 3. Environmental Quality Control Equipment - "System was down for repair of damages caused by shorting from an electrical storm. District is investigating methods of prevention of lightning damage which is a recurring problem."

The water quality monitoring system (previously referred to as the environmental quality control equipment) was found to be unreliable and costly to maintain. It was therefore abandoned and removed. A replacement system is presently in design stages.

c. Page 4. Stilling Basin - "Eroded outlet channel side slopes noted in fourth periodic inspection have not been repaired, a few guard rail posts along the access road are being undermined due to this erosion."

The affected access road guard rail posts have been reset in concrete.

d. Page 4. Sloughing or Erosion of Embankment or Abutment Slopes - "No problems noted except for slight erosion of lower portion of upstream right abutment slope. Project personnel plan to install gutter in this area to control this erosion."

Dam operating personnel installed a rock-lined gutter which appears to have satisfactorily checked the erosion.

e. Page 5. Drainage System (Spillway Chute and Gravity Walls) - "Concrete lined ditch at top of slope on right side of spillway has areas where slab has cracked, areas beneath slab have eroded and some slabs have been displaced. Realignment of slabs, backfilling of eroded areas beneath slab with lean concrete, and sealing of cracks with asphaltic or tar sealer recommended."

This situation has been satisfactorily corrected by operating personnel.

f. Page 6. Weirs (Downstream Area) - "The right abutment weir was not operational at the time of the inspection. Repairs of this weir and continued readings of all weirs is recommended."

Weir No. 3, on the right abutment, is now operational and consists of a V-notch cut in a concrete slab set upright, founded in rock.

3-02. SIXTH PERIODIC INSPECTION.

a. Replacement of the motor control centers recommended in 2-04 b (7) was accomplished in February 1977.

b. Plans and specification have been prepared for replacement of non-functional Warlam type piezometers with Casagrande type piezometers in July 1977.

SECTION 4
INSTRUMENTATION RESULTS

4-01. GENERAL. The results of readings on the existing instrumentation during the construction period and during impoundment to elevation 628 and post impoundment period through the fifth periodic inspection were presented in previous inspection reports. A discussion of the instrumentation data follows.

4-02 PIEZOMETERS. Upstream piezometers PZE-77-1, 86-2, 95-1 and 98-1 continued to respond to and hold within three feet of the reservoir operating level. One upstream piezometer, PZE 92-1, has continued to indicate piezometric levels substantially below operating pool levels. Impervious core piezometer PZC 77-2 continues to register a piezometric level at least 15 feet above that in other core instruments (PZC 86-3 and 95-3). This latter difference relates to core width at the various piezometers as noted in Periodic Report No. 2. Impervious core piezometer PZC-98-2 which experienced fluctuations and a relatively quick drop of 17 feet in 1972 has shown a slow decline of an additional 17 feet from that time to August 1976. All downstream pore pressure devices are of the pressure cell (Warlam) type. Their readings have generally become erratic and sporadic with increasing age or, in some cases, the installations have become totally inoperative. At present, only pressure cells PPF 86-5, PPF 98-3 and PPF 98-4 are operating satisfactorily. All remaining cells have either become inoperative (PPF 86-4, PPF 95-4, PPE 95-5, PPE 95-6 and PPE 98-6) or indicate unreliable readings (PPF 77-3 and PPE 98-7). PPF 86-5, located in the glacial outwash of the foundation, indicates a minimal head of two to three feet in that material at the downstream toe. PPF 98-3 and PPF 98-4 readings affirm the adequate functioning of the rockfill section as a drain. Piezometer records are shown on plates 1 through 4.

4-03. NON-TYPICAL PIEZOMETER DATA AND CHANGES.

a. Piezometer PZE 86-1. This piezometer was identified as a non-typical upstream piezometer in Periodic Inspection Report No. 2 because of its 3-foot lower reading compared with piezometer PZE 86-2 which reflects pool level. Since the difference from pool level shown by PZE 86-1 (3 feet) is small, its readings are compatible with those at PZE 86-3 and readings at the three instruments (86-1, 86-2 and 86-3) are consistant with embankment, foundation and cutoff configurations at Station 8+600, this piezometer is no longer considered to be non-typical.

b. PZE 92-1. This upstream piezometer, identified as non-typical in Periodic Inspection Report No. 2, has always shown a piezometric level substantially below the pool level which is not in agreement with its upstream location and other upstream piezometers. Its difference from the normal pool level has increased with time from 32 feet in January 1971 when normal operating pool level was reached, to 39 feet at the present. The piezometer responds well to rises and falls in pool levels. From the responses to pool level changes and the decrease in piezometric level with time, the difference from pool level is attributable to a drop in seepage potential in the embankment material between the piezometer and the pool. (The possible explanation in Report No. 2 for the difference is not valid because of incompatibility with data obtained subsequent to that report.)

c. VIF 92-2. Subsequent to the initial reservoir impoundment and up to October 1974, VIF 92-2 registered a water level at approximately elevation

625, three feet below the normal pool and 35 feet above the adjacent upstream piezometer, PZE-92-1. Since May 1975, the water level in VIF 92-2 has remained at elevation 590, consistant with the level in PZE 92-1. At that time and continuing to the present, a trickle of water could be heard falling on the water surface at el. 590 from a higher level in the inclinometer casing. Falling head tests performed in the VIF in June 1975 to investigate this change indicated very slow outflow rate* in two tests with the water level first raised 10 feet to el. 600 and then 35 feet to its former level. In a final test with dye and the water level raised 35 feet, no trace of the dye was seen in several weeks of observation. The tests and the lack of any noticeable change in normal seepage flow according to the weir readings demonstrated an absence of any radical change in permeability characteristics and it appeared that the lower water level in the VIF reflected a similar condition as that at PZE 92-1 which had existed from the time of initial impoundment. The record for PZE 92-1 shows a change (decrease) with time that can at least partially account for the change at the VIF. The condition now indicated by readings at both instruments is compatible with existence of some local seepage through the embankment into the foundation rock upstream of the grout curtain. This is in agreement with the seepage study submitted in the report of Periodic Inspections 3 and 4.

4-04. WEIRS. Records of the readings for the three weirs installed for seepage measurement are shown on plates 5 through 7. The records of these weirs as of spring of 1974 together with other applicable data were analyzed in the seepage study submitted in Report No. 4. This analysis resulted in a conclusion that the seepage as measured by the base flow over the weirs is a small controlled discharge originating, for the applicable embankment reach, from embankment seepage collected by the internal drain and underseepage thru the rock foundation. No increases in base flow amounts have been observed in the subsequent readings and the findings of the study that the seepage is normal and does not affect embankment safety remain unchanged.

The estimated base flow at Weir No. 1, originally set at 0.4 cfs based on the records available through June 1974, has been revised downward to 0.3 cfs (130 gpm) based on subsequent readings for dry periods in 1974 and 1975. The base flow at Weir No. 2 has shown a gradual long term reduction since its installation in 1972. Initially, from November 1972 to June 1973, the base flow appeared to be approximately 0.2 cfs. This flow dropped gradually during the period June 1973 to March 1976 to its present level of 0.02 cfs (9gpm). The base flow at Weir No. 3 has remained at 0.02 cfs since its installation in June 1972. The gradual reduction of base flow which

*Inflow - outflow along the height of the VIF can occur through the blank loose-fitting couplings at the 5-foot long casing sections in accordance with the piezometric pressure distribution in the embankment surrounding the instrument. The bottom is sealed in shale with grout.

has been observed at Weir No. 2 is due to minor local changes in seepage paths near the left embankment-abutment interface at the downstream toe and bypassing of the weir rather than reduction in overall seepage quantities since no corresponding long term reduction has been noted in the base flow at Weir No. 1 which receives the flow from Weir No. 2. The reduced base flow estimate for Weir No. 1 is the result of the longer term of record rather than a long term reduction in flow.

4-05. VERTICAL INCLINATION INSTRUMENTS.

a. General. These instruments permit measurement of movement parallel and perpendicular to the dam centerline and horizontal settlements within any portion of the embankment height. The summarized readings, current as of 9-11 June 1976 are shown in Table 1.

b. Settlement. The maximum settlements for VIF 92-2, 95-2 and 98-5 have the same zones as for the fifth inspection. These instruments have indicated maximum settlement decreases since the fifth periodic inspection reports of 0.03, 0.03 and 0.05 feet respectively.

c. Horizontal Movement. All three inclinometers indicated an initial upstream (easterly) movement prior to impoundment and a downstream (westerly) trend during reservoir filling. The maximum movement in the east-west direction was recorded in instrument 92-2 during April of 1971 and again in June 1976, and the maximum movement in the north-south direction was recorded in 92-2 during February of 1970. During the period 15 October 1974 to 10 June 1976, generally very little movement has occurred in the inclinometers. The maximum movements amount to 1.13 inches in the east-west direction (VIF 92-2) and 0.38 inches in the north-south direction (VIF 92-2) during the 20 month period. Since the fifth periodic inspection east-west movement at elevation 627.4 in VIF 92-2 changed from 0.67 inches east (Oct 1974) to 0.46 inches west (May 1975) and back to 0.73 inches east (June 1976), possibly indicating an erroneous 1975 reading.

4-06. SURFACE SETTLEMENT PIPES. Surface settlement readings, which are shown in Table 2, were presented in the second through fifth periodic inspection reports. During the period from 15 October 1974 to 10 June 1976, surveys indicated negligible movement in the horizontal (less than 0.04 feet) and in the vertical (less than 0.06 feet). As with the fifth periodic inspection report, the largest cumulative settlement reading of the seventeen pipes occurs at SP-5.

4-07. SERVICE BRIDGE. A study of the tower bridge movement in both the horizontal and vertical direction has been undertaken since August of 1971 (shown in Tables 3, 4, 5). Since the initial measurements, the readings have been obtained on a yearly basis. The survey points are punch marks in the fixed plate and movable bar at each plate expansion dam of the

bridge roadway. The points are numbered from one to ten beginning at the bridge-embankment abutment and proceeding eastward.

The elevations taken at the bridge punch marks indicate little or no movement except at the bridge-embankment abutment which has settled 0.10 foot in the five year observation period. No problems have been indicated by the movement records. The District will continue to monitor this feature of the project and evaluate the movements.

The results of the tower bridge's expansion-contraction movement are presented in Table 5. Since the anchor nut was loosened at the slotted expansion bearing subsequent to the fourth periodic inspection, expected movement between survey points 5 and 6 has been noted.

4-08. SPILLWAY BRIDGE. A study of the spillway bridge movement in both the horizontal and vertical direction has been undertaken since October 1974 (shown in Tables 6, 7, 8). The readings have been obtained on a yearly basis. The survey points are punch marks in the fixed plate and movable bar at each plate expansion dam of the bridge roadway. The points are numbered from one to eight beginning at the right abutment of the spillway and proceeding southeast. Also included in this study is a measure of the plumb of the two bridge piers.

The results of these surveys indicate very little movement has taken place in the two year period. Monitoring of the spillway bridge will continue.

SECTION 5
ENVIRONMENTAL QUALITY CONTROL EQUIPMENT

The environmental quality control system which was described in Periodic Inspection Reports No. 3 and No. 4 and has been in operation for three years is being removed and will be replaced with a simpler, more reliable method of controlling the quality of the reservoir releases. The original control system was plagued with operational difficulties which are described in the three previous Periodic Inspection Reports.

SECTION 6
SUMMARY

The overall condition of the project is considered good. The two items of most concern to the inspection party were: (1) the deterioration of the motor control units in the tower and (2) the loss or faulty operations, since the dam's construction, of a total of eight piezometers of the Warlam type, all of which are located downstream of the dam centerline (two of this total have been inoperative since October 1974). The motor control units have been replaced and action is in progress to correct other deficiencies prior to October 1977.

TABLE 1

VERTICAL INCLINATION DATA SUMMARY

Installation	Ht. of Fill Above Bottom of casting (ft.)	Maximum Settlement and Zone 6-10-76	North — South		East — West	
			Direction	Maximum Deflection	Direction	Maximum Deflection
VIF 92-2 (Rt Abut)	151	1.68' 605.96-610.96	North North	3.14" 2/70 1.98" 10/74	East East	5.92" 6/76 5.43" 10/74
VIF 95-2 Closure	169	1.93' 604.72-609.72	South South	-3.04" 9/70 -2.67" 6/76	East West	3.80" 8/70 -2.36" 6/76
VIF 98-5 (Left Abut)	115	1.27' 608.72-613.72	North North	1.73" 11/71 1.58" 6/76	East East	3.58" 8/71 3.11" 6/76

TABLE 2

Surface Settlement Data
Settlement Pipe - Offset & Elevations

1 Instrument Number	2 Station	3 Height of Fill	4 Initial Survey Date	5 Initial ℄ Offset	6 Offset 6 Jun 76	*7 Offset Diff.	8 Initial Elev.	9 Elevation 6 Jun 76	10 Diff. Elev.
SP-1	6+901.03	27	9 July 70	14.49	14.47	-0.02	672.04	672.04	0.00
SP-2	7+401.03	44	9 July 70	14.50	14.50	0.00	672.04	672.03	0.01
SP-3	7+901.42	72	9 July 70	14.50	14.54	0.04	672.06	671.97	0.09
SP-4	8+401.48	74	9 July 70	14.41	14.42	0.01	672.03	671.85	0.18
SP-5	8+901.15	91	9 July 70	14.40	14.56	0.16	672.04	671.52	0.52
SP-6	9+401.43	166	9 July 70	14.58	14.54	-0.04	672.02	671.83	0.19
LBS-1	9+580.0	172	18 Dec 70	14.44	14.47	0.03	671.68	671.50	0.18
LBS-2	9+630.0	172	18 Dec 70	14.55	14.50	-0.05	672.00	671.86	0.14
LBS-3	9+680.0	172	18 Dec 70	14.58	14.52	-0.06	672.04	671.89	0.15
LBS-4	9+730.0	172	18 Dec 70	14.53	14.40	-0.13	672.05	671.91	0.14
LBS-5	9+780.0	146	18 Dec 70	14.79	14.72	-0.07	672.04	671.90	0.14
LBS-6	9+830.0	118	18 Dec 70	14.74	14.70	-0.04	671.97	671.79	0.18
LBS-7	9+880.0	116	18 Dec 70	14.55	14.51	-0.04	671.86	671.73	0.13
SP-7	9+901.71	116	9 July 70	14.51	14.51	0.00	672.03	671.88	0.15
LBS-8	9+930.0	65	18 Dec 70	14.38	14.34	-0.04	672.12	672.02	0.10
LBS-9	9+980.0	16	18 Dec 70	14.53	14.52	-0.01	672.32	672.25	0.07
LBS-10	10+030.0	0	14 & 27 May 71	13.67	13.66	-0.01	688.10	688.10	0.00

* Upstream positive (+), downstream negative (-)

TABLE 3

Tower Bridge Movement Study
Beltzville Lake

MARK NUMBERS	PUNCHMARK ELEVATIONS DATE										
	8/13/71	7/12/72	9/13/72	12/8/72	3/20/73	7/3/73	9/21/73	1/7/74	4/10/74	7/15/74	10/17/74
10	672.087	672.09	672.09	672.09	672.08	672.09	672.07	672.07	672.10	672.10	672.09
9	672.078	672.07	672.07	672.06	672.07	672.07	672.05	672.06	672.08	672.08	672.07
8	672.097	672.10	672.10	672.11	672.12	672.11	672.09	672.11	672.14	672.13	672.14
7	672.081	672.08	672.09	672.09	672.10	672.09	672.08	672.10	672.11	672.12	672.12
6	672.091	672.08	672.08	672.11	672.10	672.08	672.08	672.09	672.09	672.10	672.09
5	672.073	672.07	672.07	672.09	672.08	672.07	672.05	672.08	672.08	672.08	672.08
4	672.049	672.06	672.06	672.08	672.08	672.06	672.04	672.06	672.08	672.08	672.07
3	672.045	672.06	672.05	672.08	672.07	672.06	672.03	672.05	672.08	672.07	672.07
2	671.750	671.71	671.71	671.73	671.72	671.69	671.66	671.68	671.71	671.67	671.68
1	671.724	671.69	671.69	671.71	671.70	671.67	671.64	671.85	671.69	671.65	671.65

TABLE 3 (Cont'd)

Tower Bridge Movement Study
Beltzville Lake

MARK NUMBERS	PUNCHMARK ELEVATIONS DATE 5/13/75	6/10/76
10	672.09	672.12
9	672.06	672.10
8	672.14	672.17
7	672.12	672.15
6	672.09	672.11
5	672.08	672.09
4	672.07	672.09
3	672.07	672.08
2	671.66	671.66
1	671.64	671.65

TABLE

Tower Bridge Movement Study
Beltzville Lake

Tower Bridge Centerline Offset- N (+)											Mark
8/12/71	7/12/72	9/13/72	12/8/72	3/21/73	7/3/73	9/21/73	1/7/74	4/10/74	7/15/74	10/17/74	Number
-	-	-	-	-	-	-	-	-	-	-	10
0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	-	0.000	-	9
0.000	0.018	0.025	0.045	0.040	0.043	0.063	0.093	0.096	0.065	0.089	8
0.000	0.015	0.025	0.040	0.045	0.042	0.067	0.088	0.088	-0.068	0.088	7
0.000	0.000	0.005	0.010	0.005	0.007	0.015	0.032	0.033	0.000	0.000	6
0.000	0.000	0.010	0.010	0.005	0.007	0.014	0.024	0.027	0.000	-0.011	5
0.000	0.000	0.010	0.010	0.008	0.010	0.014	0.015	0.015	0.000	-0.049	4
0.000	0.000	0.010	0.010	0.007	0.008	0.010	0.033	0.040	0.000	-0.030	3
0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.015	2
-	-	-	-	-	-	-	-	-	-	-	1

TABLE 1 Cont'd)

Tower Bridge Movement Study
Beltzville Lake

Tower Bridge Centerline Offset - N (+)		Mark Number
5/13/75	6/10/76	
0.000	0.00	10
-	0.00	9
0.100	0.09	8
0.100	0.09	7
0.021	0.02	6
0.022	0.02	5
0.017	0.02	4
0.017	0.02	3
0.000	0.00	2
0.000	0.00	1

TABLE 5

Tower Bridge Movement Study
Beltzville Lake

DISTANCE BETWEEN SPAN PUNCH MARKS

Mark Number	8/12/71	7/12/72	9/13/72	12/8/72	3/21/73	7/3/73	9/21/73	1/7/74	4/10/74	7/15/74	10/17/74
10	0.500	0.495	0.505	0.500	0.498	0.498	0.503	0.500	0.496	0.498	0.496
9											
8	0.496	0.490	0.515	0.565	0.548	0.502	0.545	0.515	0.587	0.505	0.547
7											
6	0.500	0.495	0.510	0.498	0.500	0.498	0.503	0.495	0.490	0.485	0.480
5											
4	0.500	0.490	0.520	0.568	0.550	0.505	0.550	0.563	0.542	0.520	0.570
3											
2	0.500	0.510	0.525	0.550	0.550	0.510	0.528	0.540	0.530	0.500	0.510
1											

TABLE 5 Cont'd

Tower Bridge Movement Study
Beltzville Lake

DISTANCE BETWEEN SPAN PUNCH MARKS

Mark Number	5/13/75	6/10/76
10		
	0.495	0.593
9		
8		
	0.485	0.583
7		
6		
	0.486	0.590
5		
4		
	0.503	0.617
3		
2		
	0.490	0.485
1		

TABLE 6

Spillway Bridge Movement Study
Beltzville Lake

MARK NUMBERS	PUNCH MARK ELEVATIONS		
	10/18/74	5/13/75	6/10/76
8	691.25	691.23	691.23
7	691.24	691.23	691.23
6	695.28	695.27	695.26
5	695.29	695.28	695.27
4	699.26	697.27	699.26
3	699.28	699.29	699.29
2	703.23	703.22	703.22
1	703.22	703.21	703.22

TABLE 7

Spillway Bridge Movement Study
Beltzville Lake

SPILLWAY BRIDGE CENTERLINE OFFSET - NE (+)

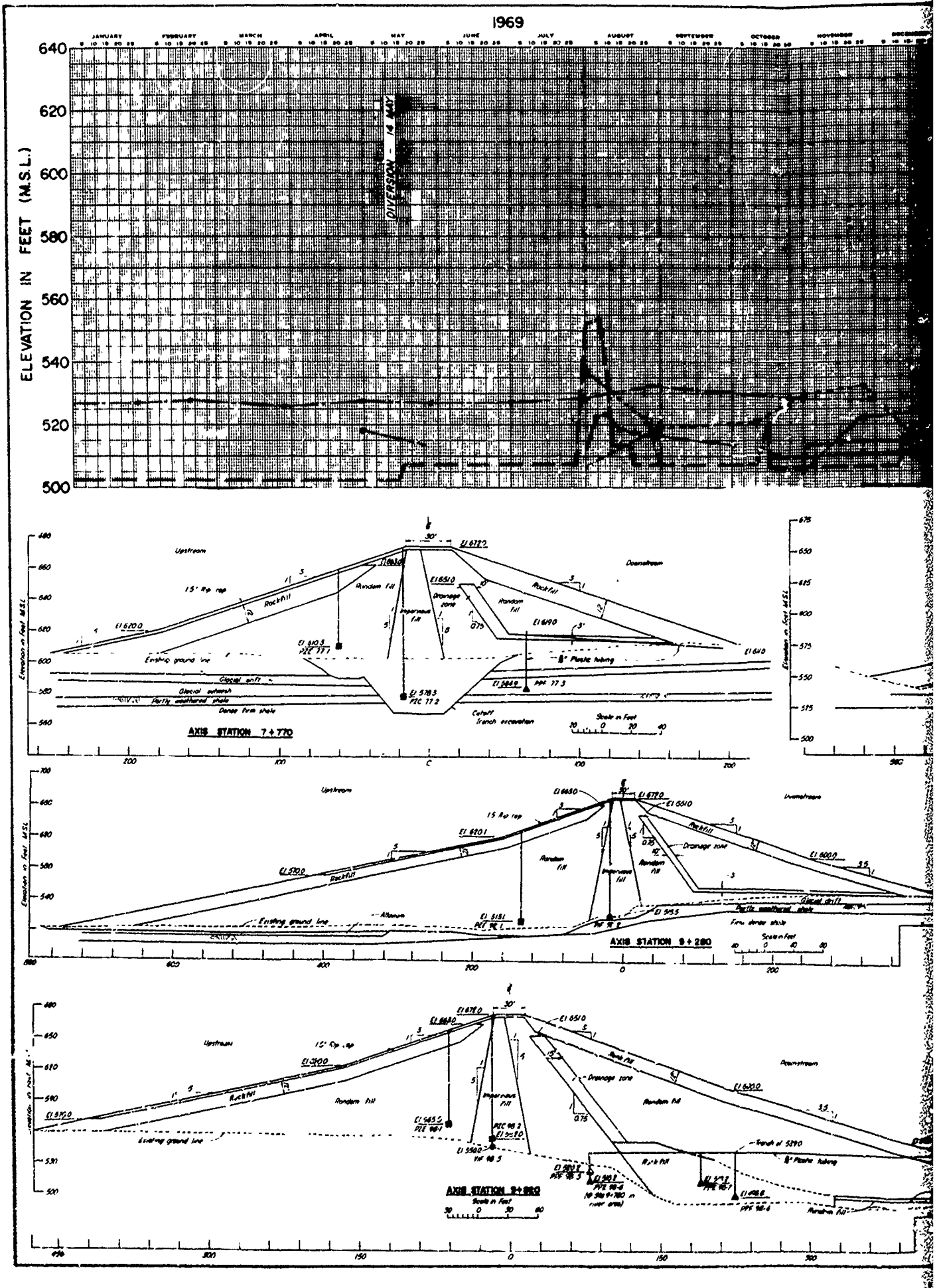
Mark Number	10/18/74	5/13/75	6/10/76
8	0.000	-0.028	-0.02
7	0.000	-0.030	-0.02
6	0.000	-0.002	-0.01
5	0.000	-0.031	-0.02
4	0.000	0.029	-0.01
3	0.022	0.014	0.00
2	0.000	0.010	0.00
1	0.000	0.000	0.01

TABLE 8

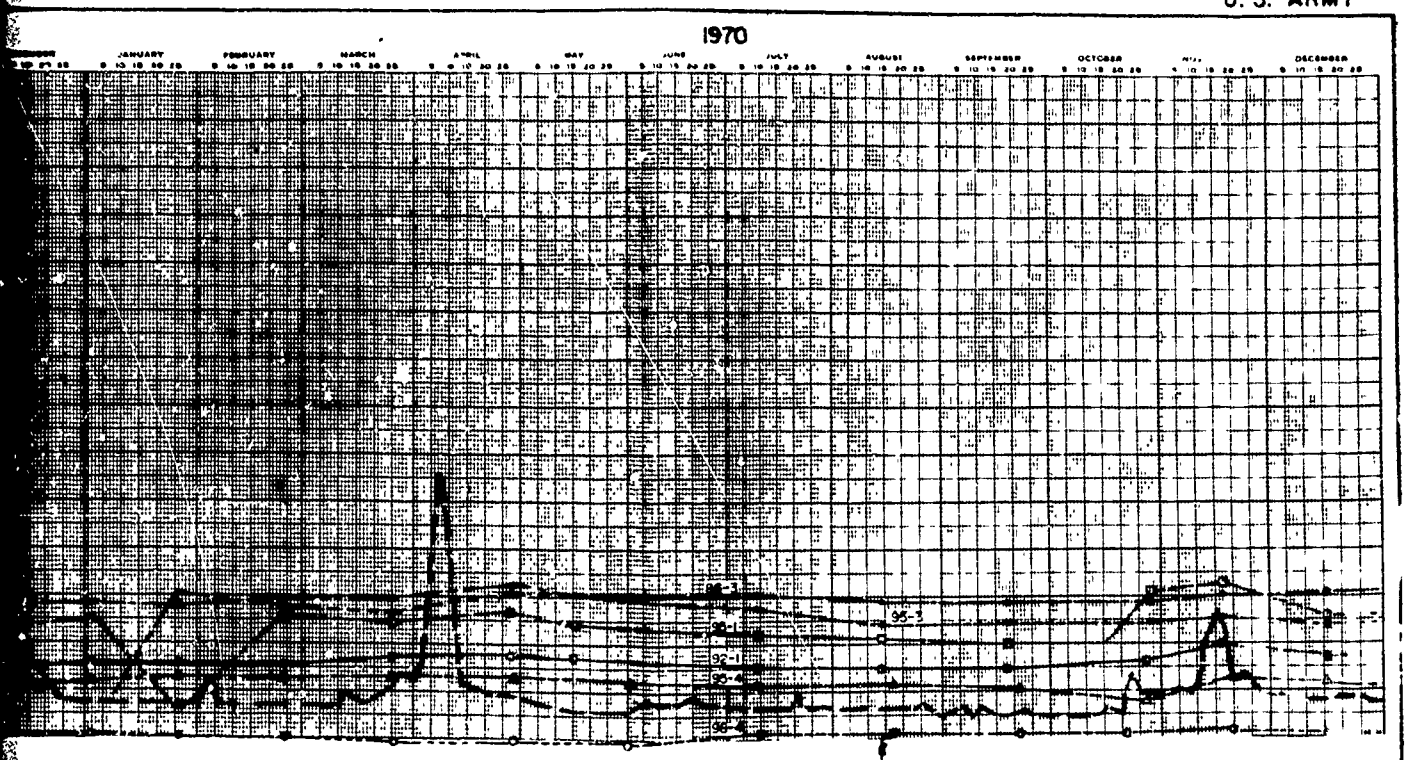
Spillway Bridge Movement Study
Beltzville Lake

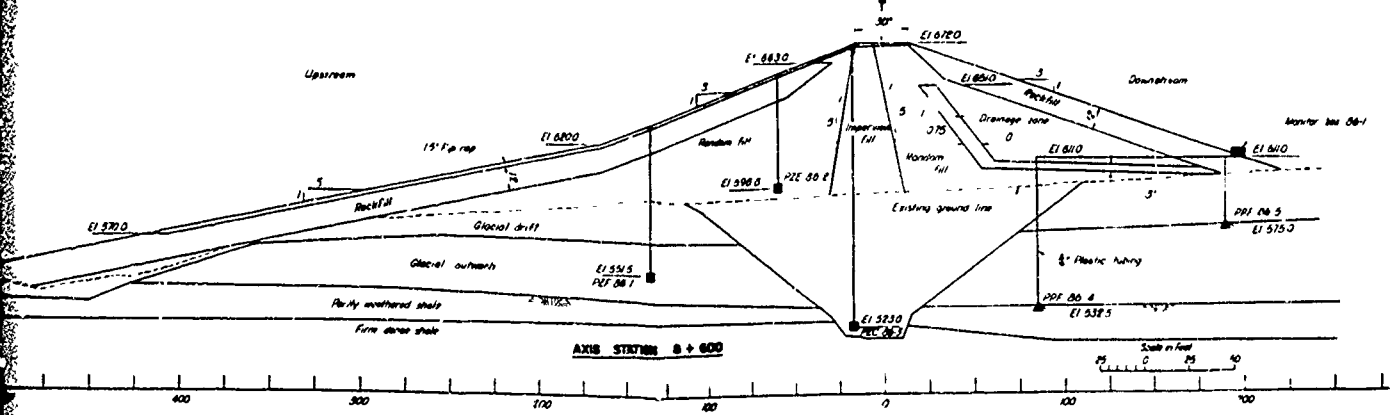
DISTANCE BETWEEN SPAN PUNCH MARKS

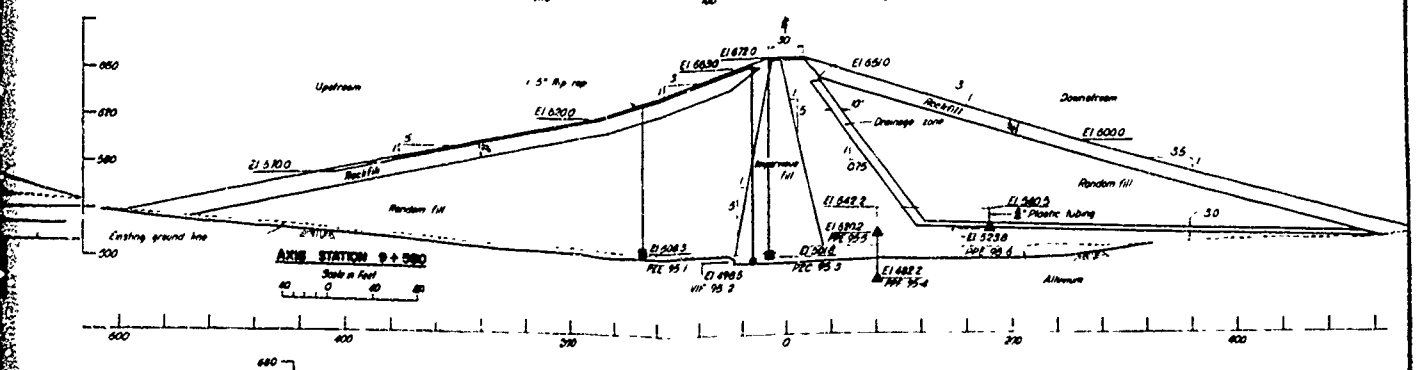
Mark Number	10/18/74	5/13/75	6/10/76
8			
	0.498	0.501	0.500
7			
6			
	0.741	0.712	0.711
5			
4			
	0.661	0.632	0.640
3			
2			
	0.715	0.685	0.660
1			

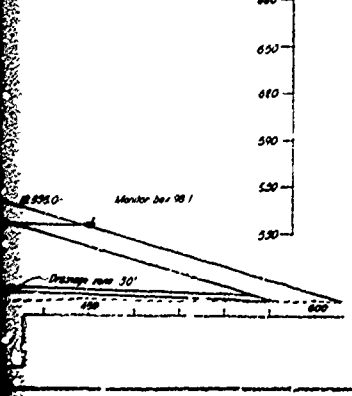

1969
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
ELEVATION IN FEET (M.S.L.)
640
620
600
580
560
540
520
500
DIVERSION - 14 MAY
AXIS STATION 7+770
Upstream
Downstream
15" Rip rap
Rockfill
Random fill
Impervious fill
Drainage zone
Existing ground line
Glacial drift
Partly weathered shale
Dense firm shale
Cutoff trench excavation
Scale in Feet
AXIS STATION 9+280
AXIS STATION 9+980

U. S. ARMY









LEGEND

- PRESSURE CELL - WARK-IM
- VERTICAL INCLINATION INST. SLOPE INDICATOR
- PIEZOMETER - CASAGRANDE TYPE
- RIVER OR RESERVOIR POOL
- PZC-96-3
- PZE-92-1
- PZE-95-1
- PZC-95-3
- PPF 98-4
- PPF-98-4

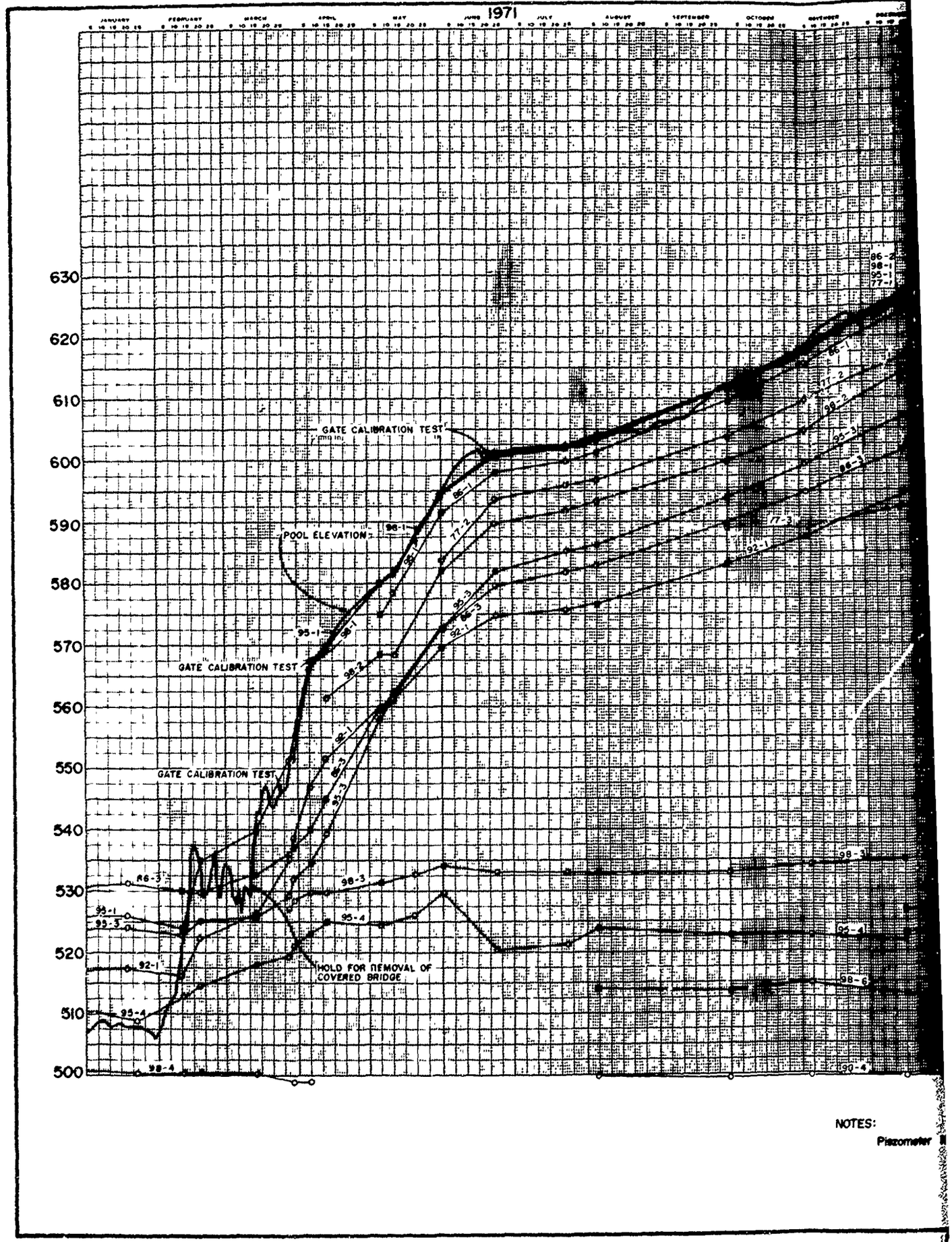
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.

BELTZVILLE LAKE

PIEZOMETER DATA
1969-1970

PLATE 1

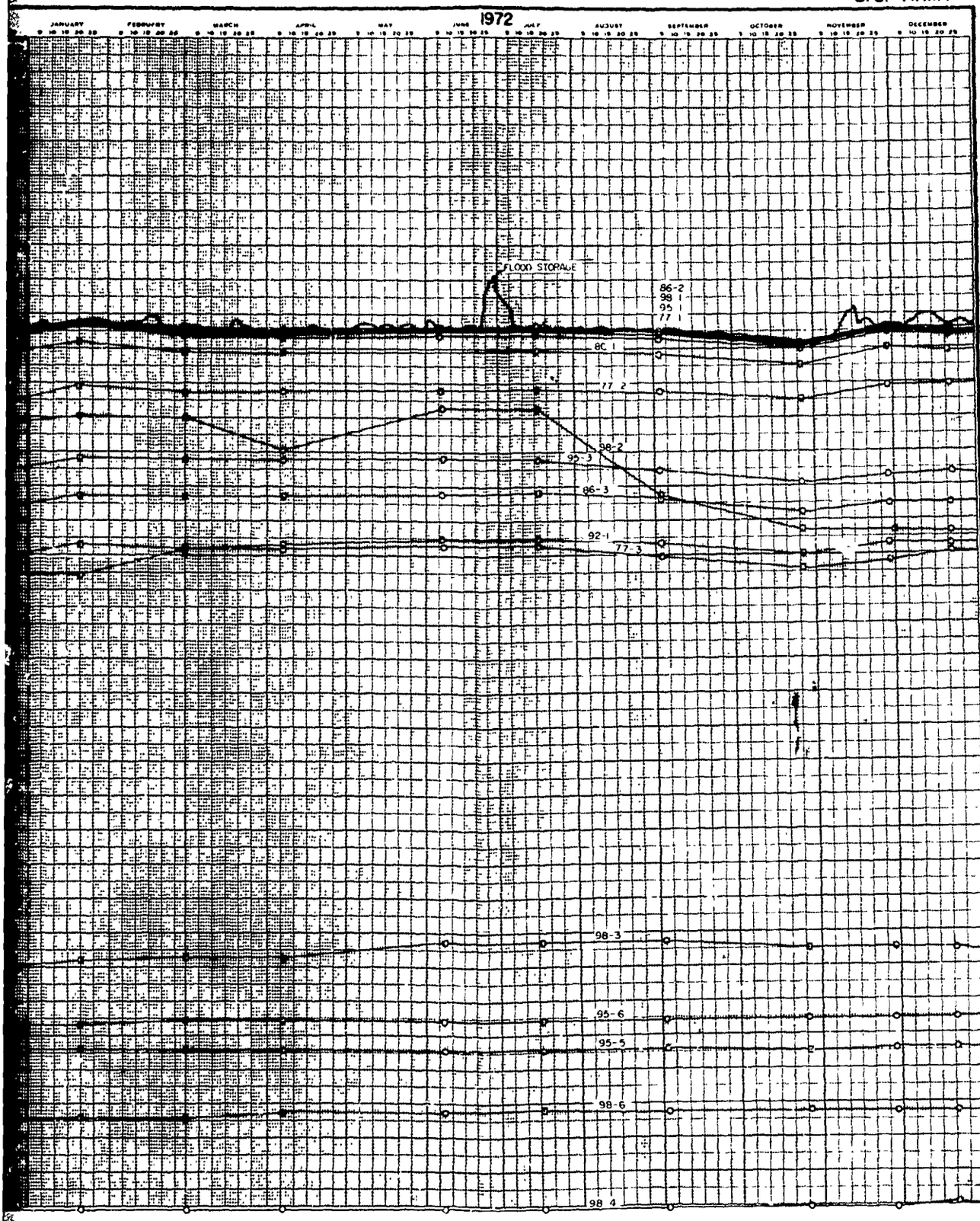
CORPS OF ENGINEERS



NOTES:

Piezometer

U.S. ARMY



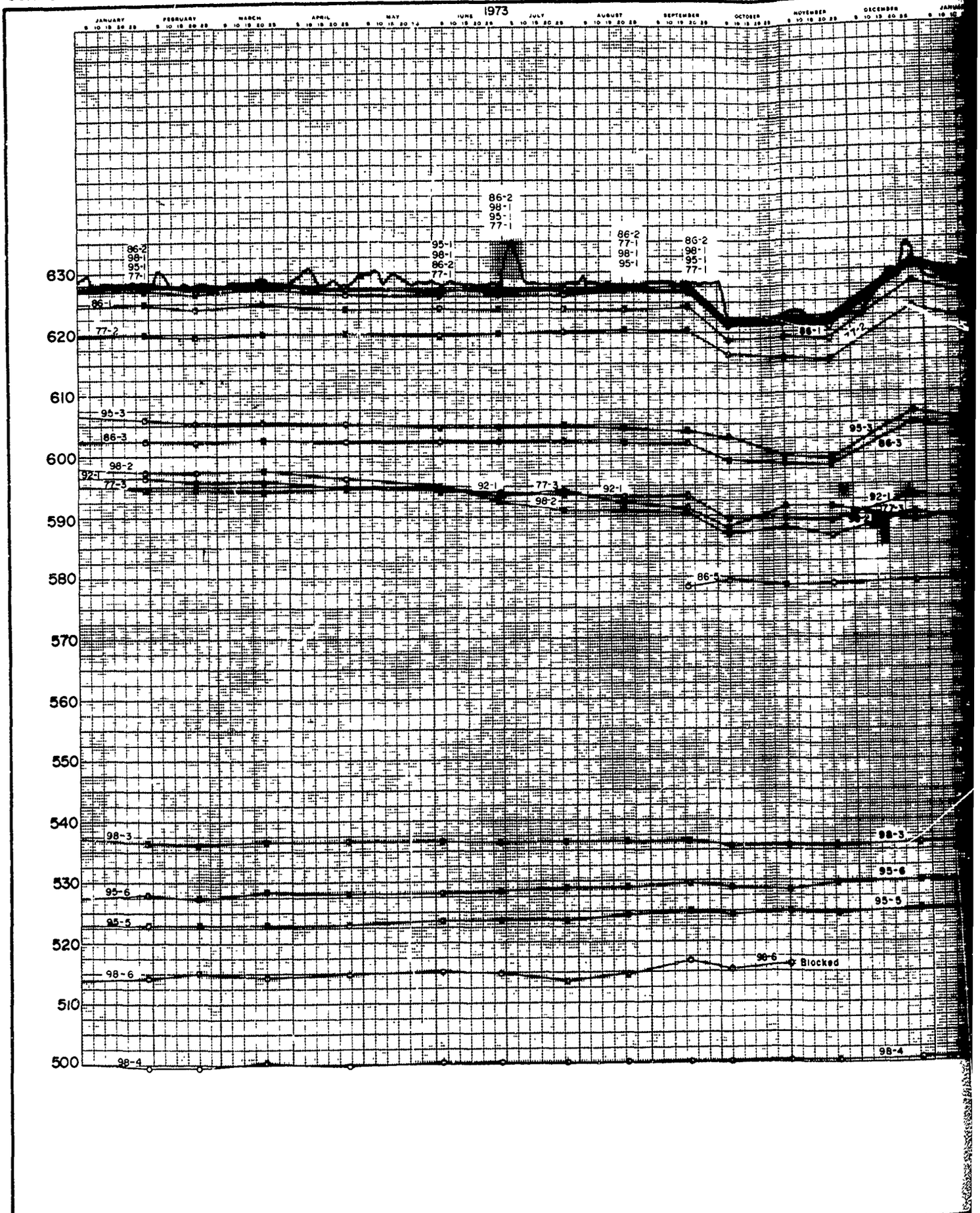
No. 95-4 became inoperative after 15 Dec. 1971

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE

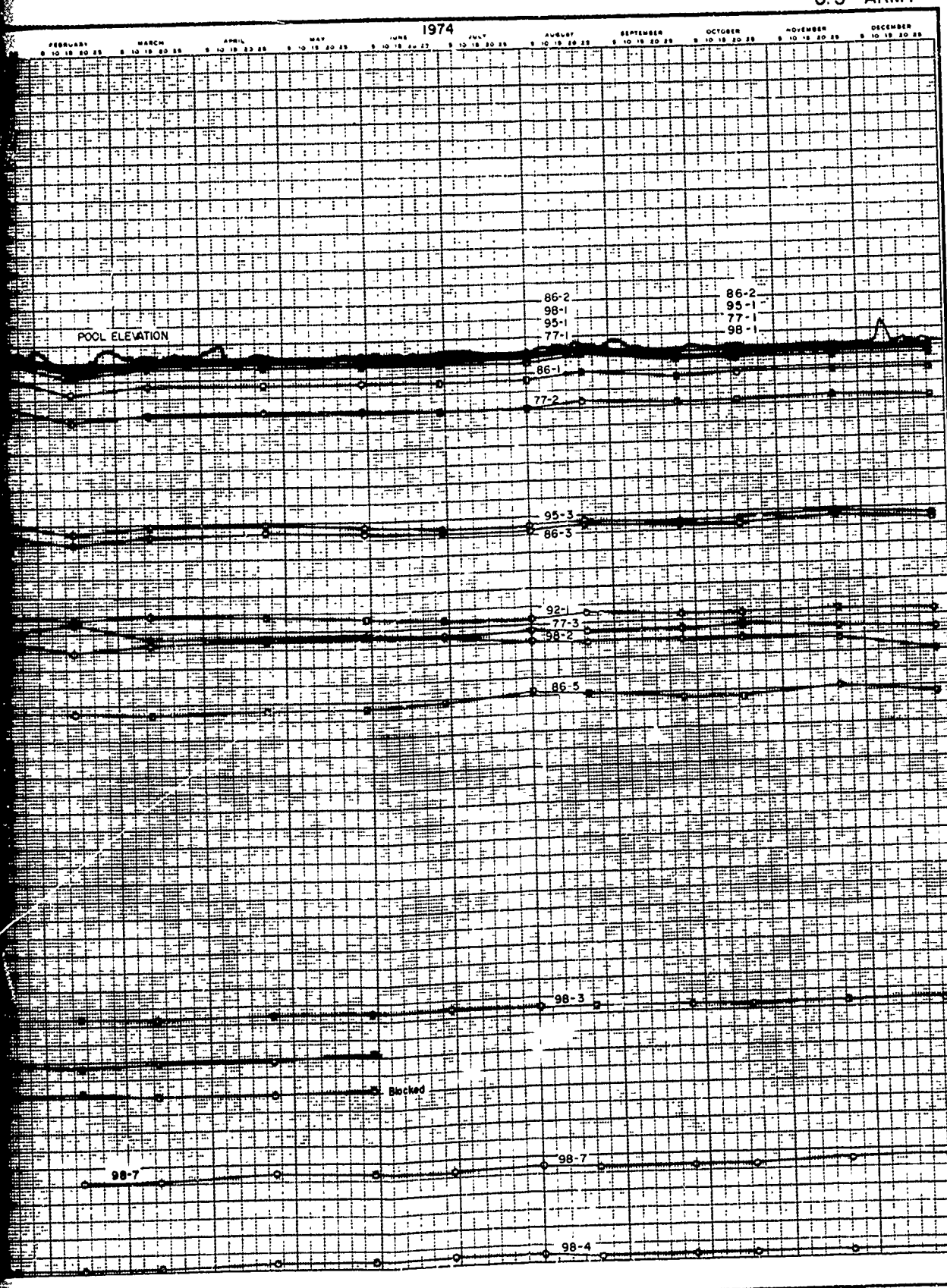
PIEZOMETER DATA
1971 – 1972

PLATE 2

CORPS OF ENGINEERS



U.S ARMY

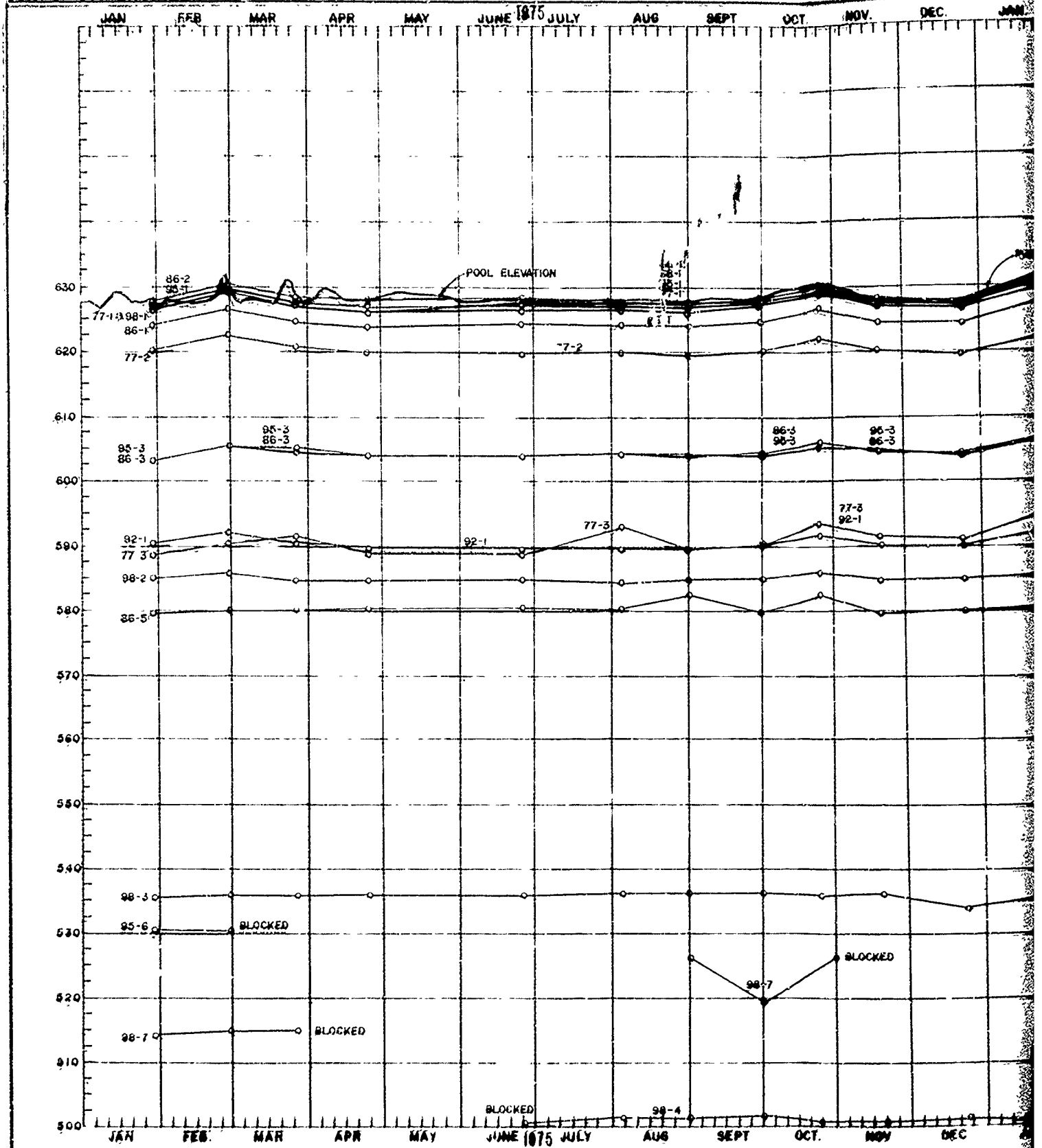


LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE

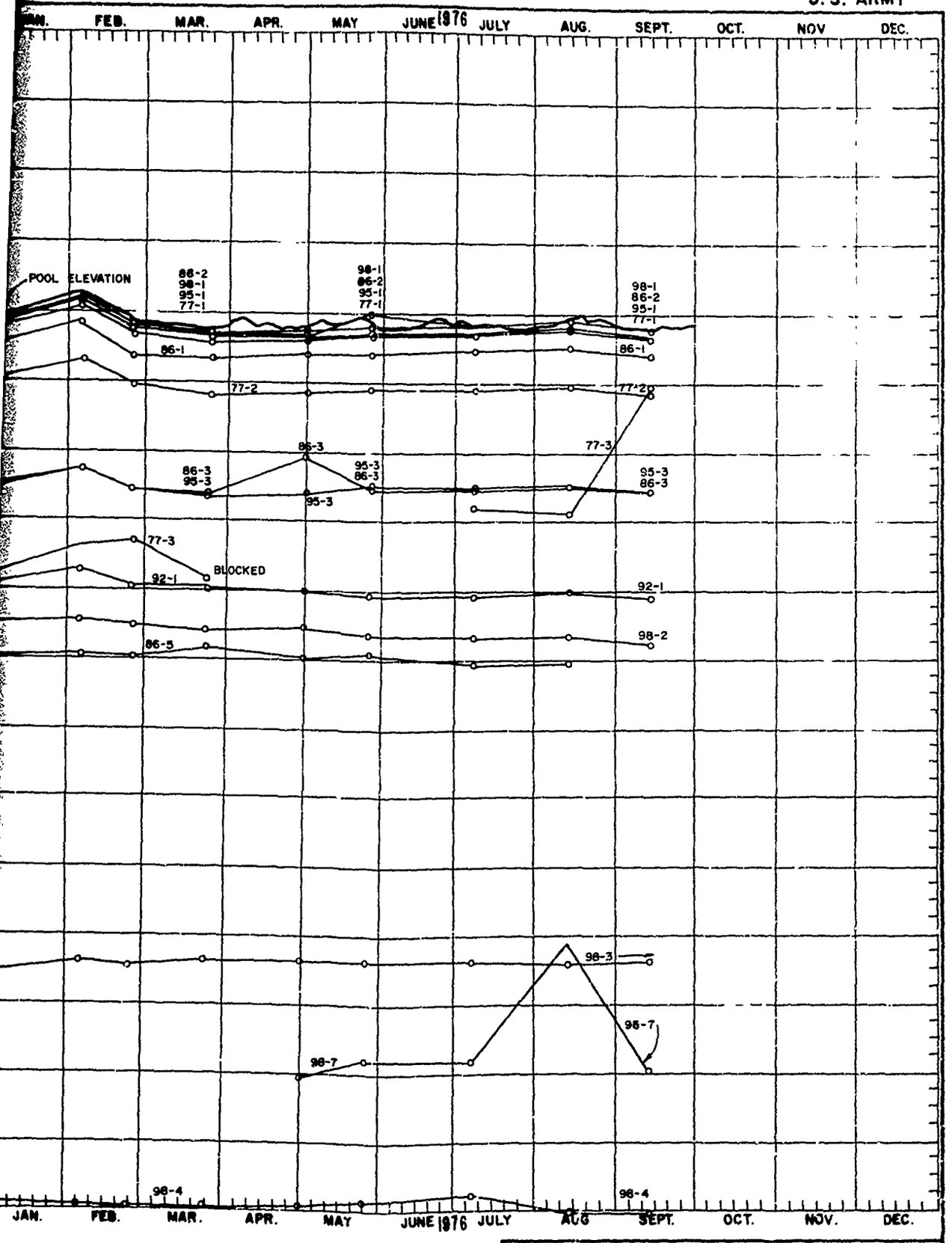
PIEZOMETER DATA
1973-1974

PLATE 3

CORPS OF ENGINEER



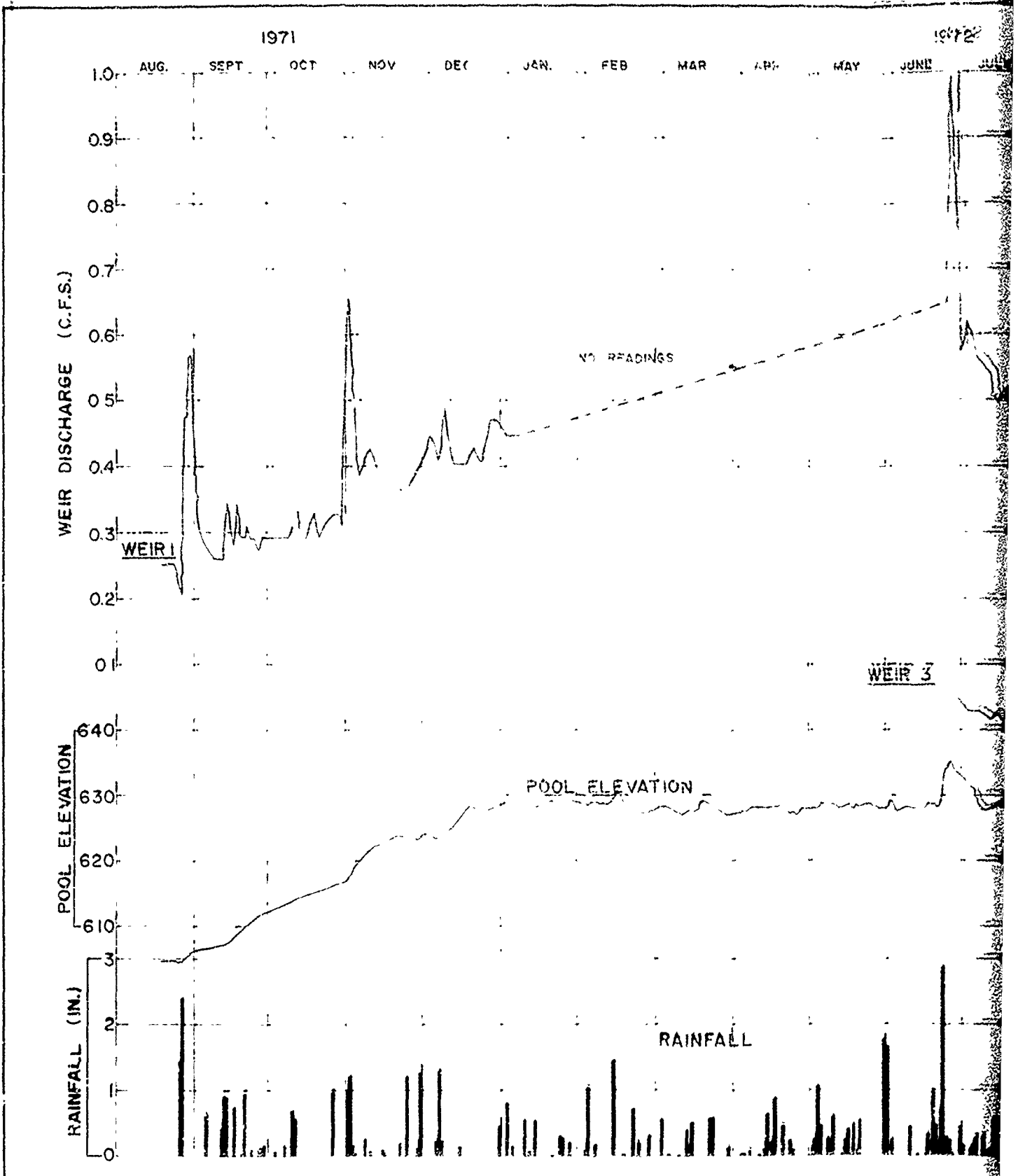
U. S. ARMY

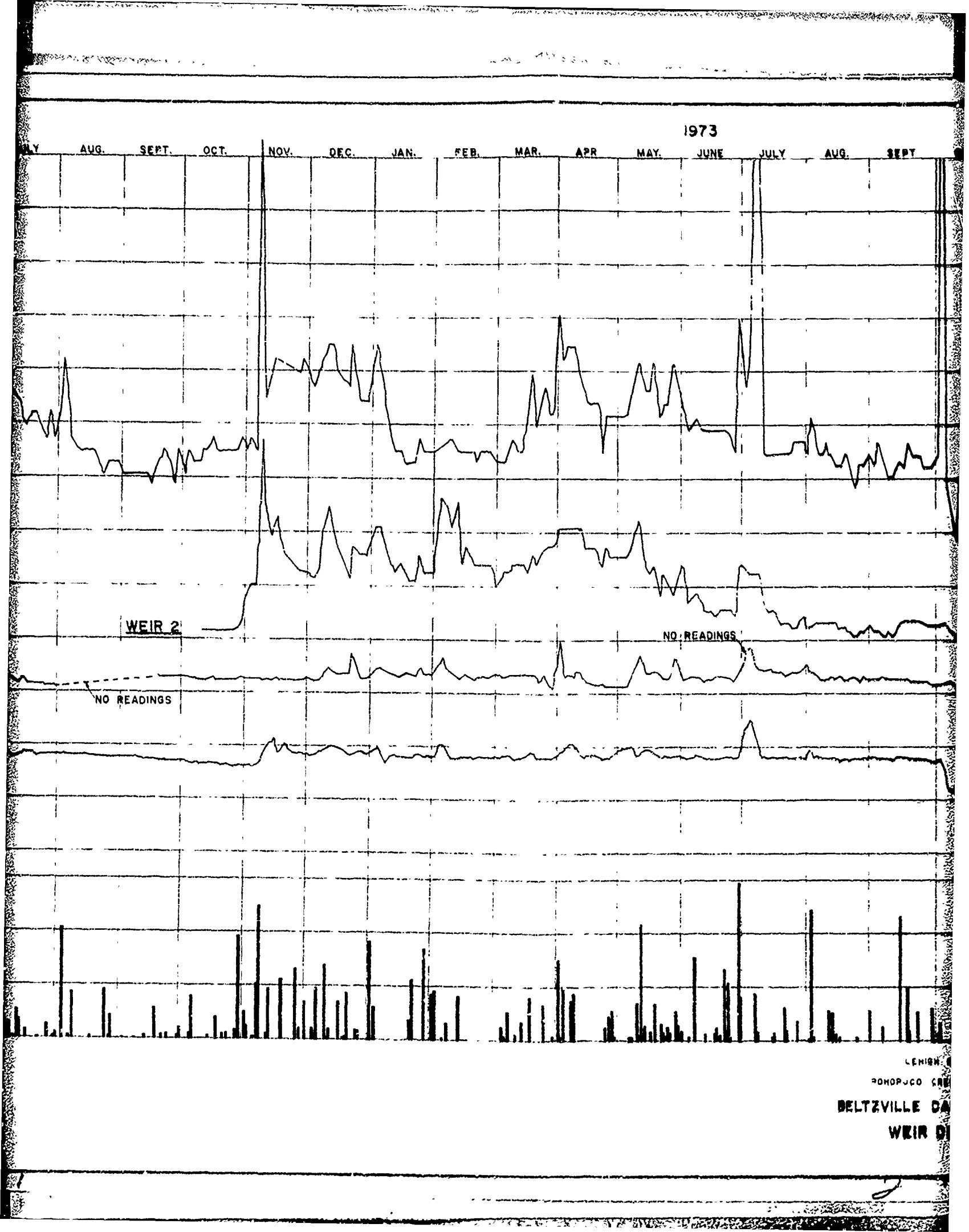


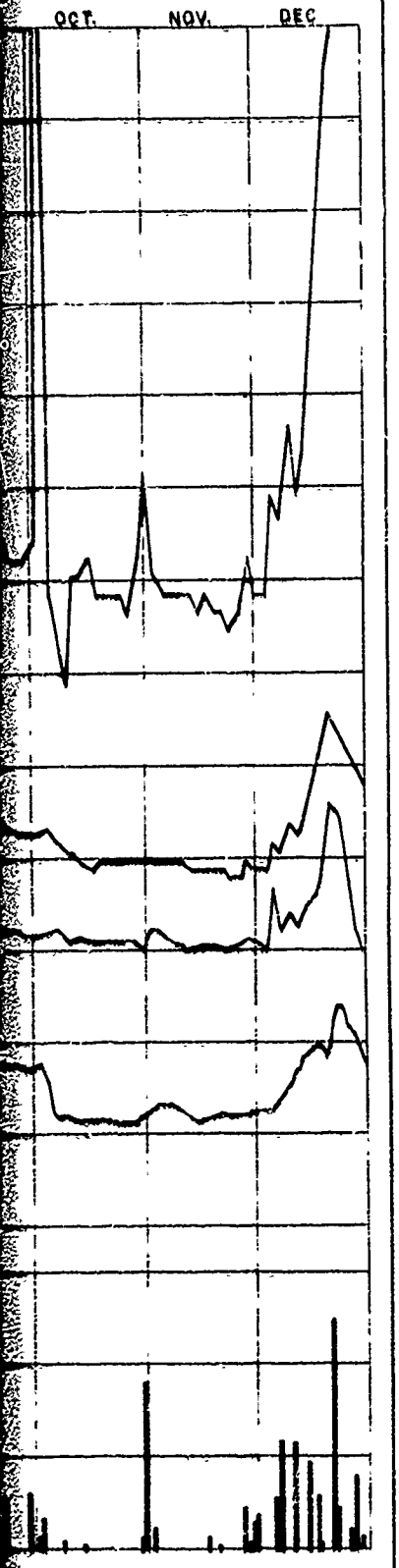
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
PIEZOMETER DATA
1975 - 1976

2

PLATE 4


1971
AUG.
SEPT.
OCT.
NOV.
DEC.
JAN.
FEB.
MAR.
APR.
MAY
JUNE
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
WEIR DISCHARGE (C.F.S.)
NO READINGS
WEIR 1
WEIR 3
640
630
620
610
POOL ELEVATION
POOL ELEVATION
3
2
1
0
RAINFALL (IN.)
RAINFALL

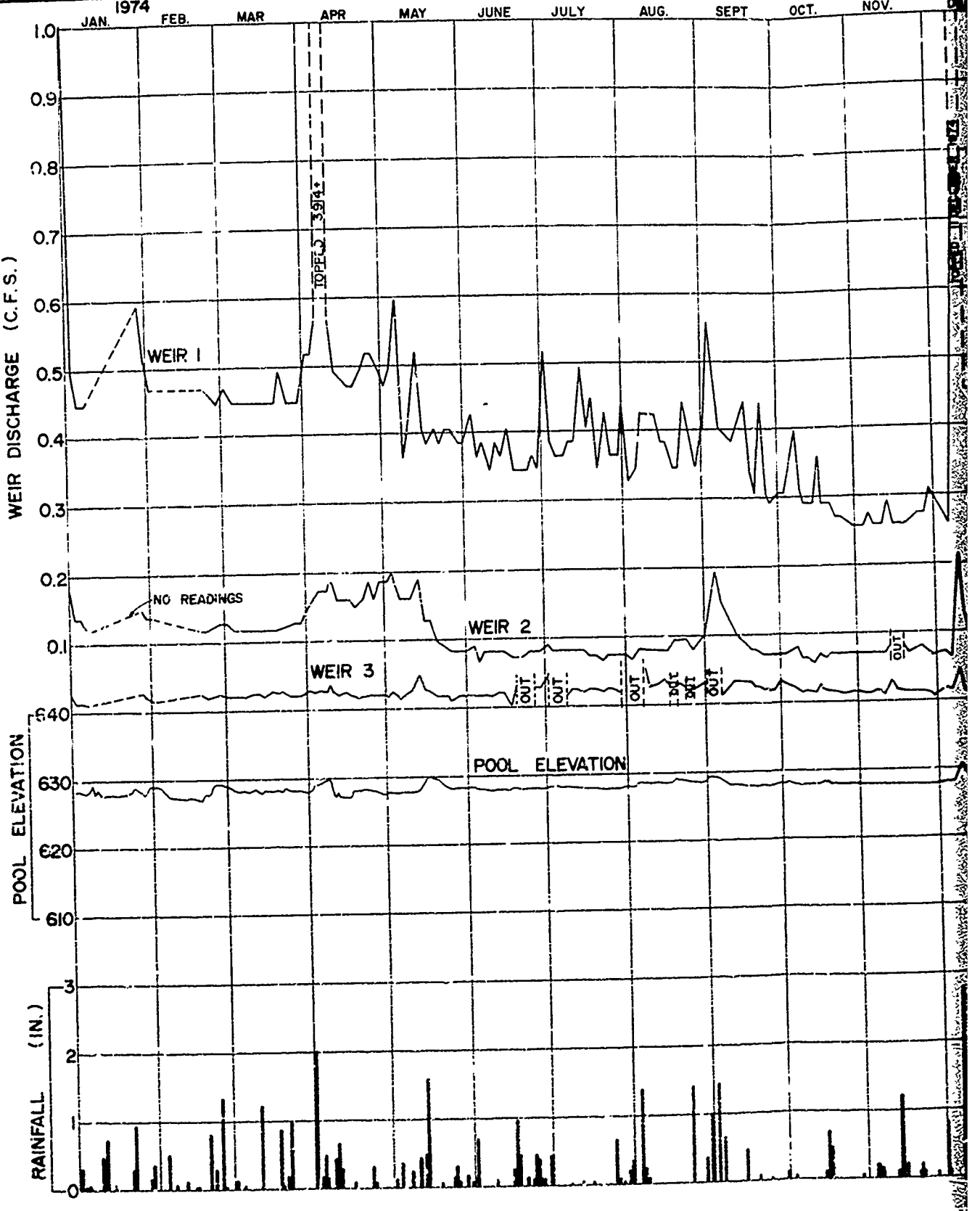

1973
LY
AUG.
SEPT.
OCT.
NOV.
DEC.
JAN.
FEB.
MAR.
APR
MAY.
JUNE
JULY
AUG.
SEPT
WEIR 2
NO READINGS
NO READINGS
LEHIGH
POHOPOCO CR
BELTZVILLE DA
WEIR D



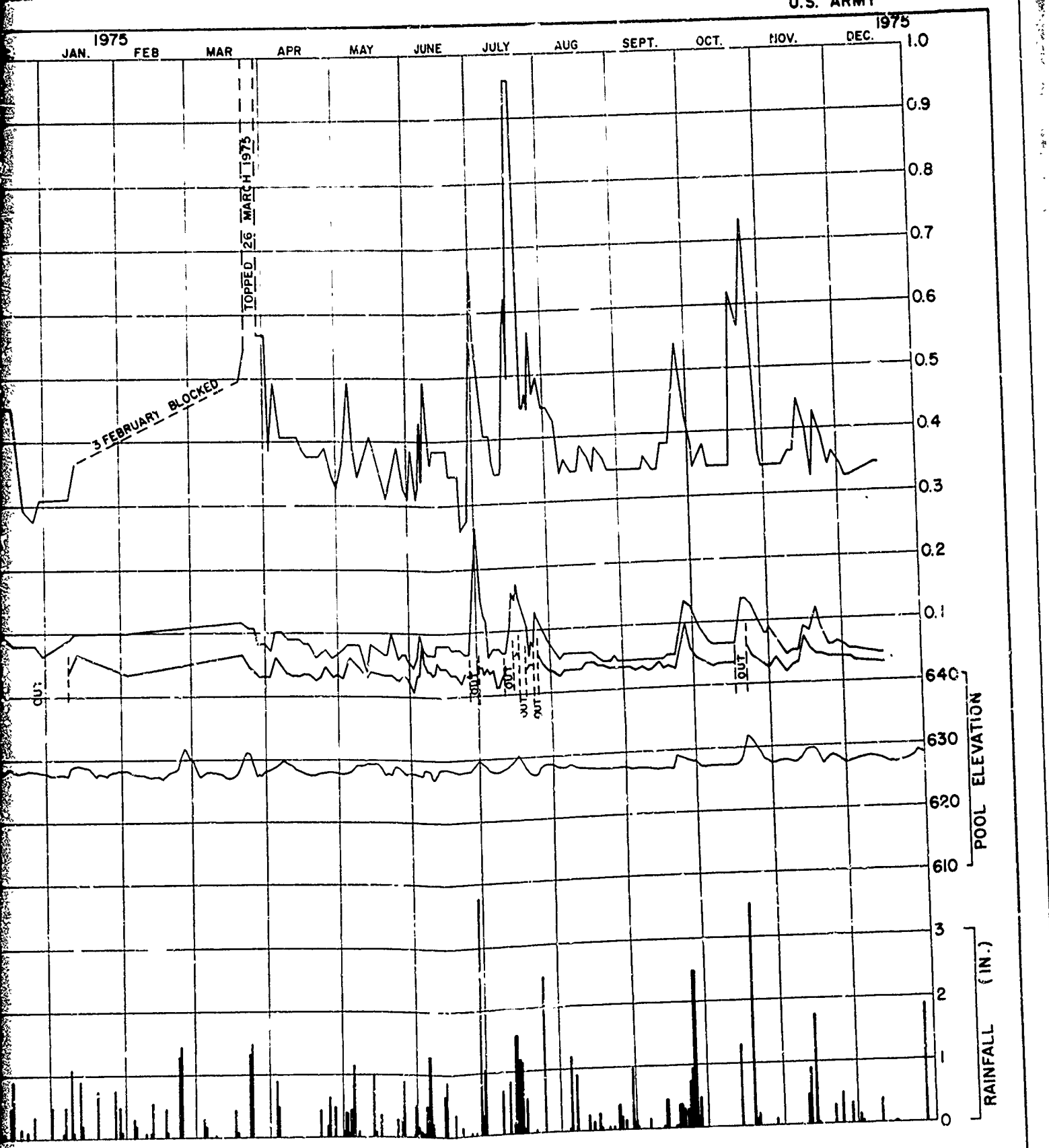
GH RIVER BASIN
CREEK, PENNSYLVANIA
DAM & RESERVOIR
DISCHARGE

PLATE 5

CORPS OF ENGINEER



U.S. ARMY



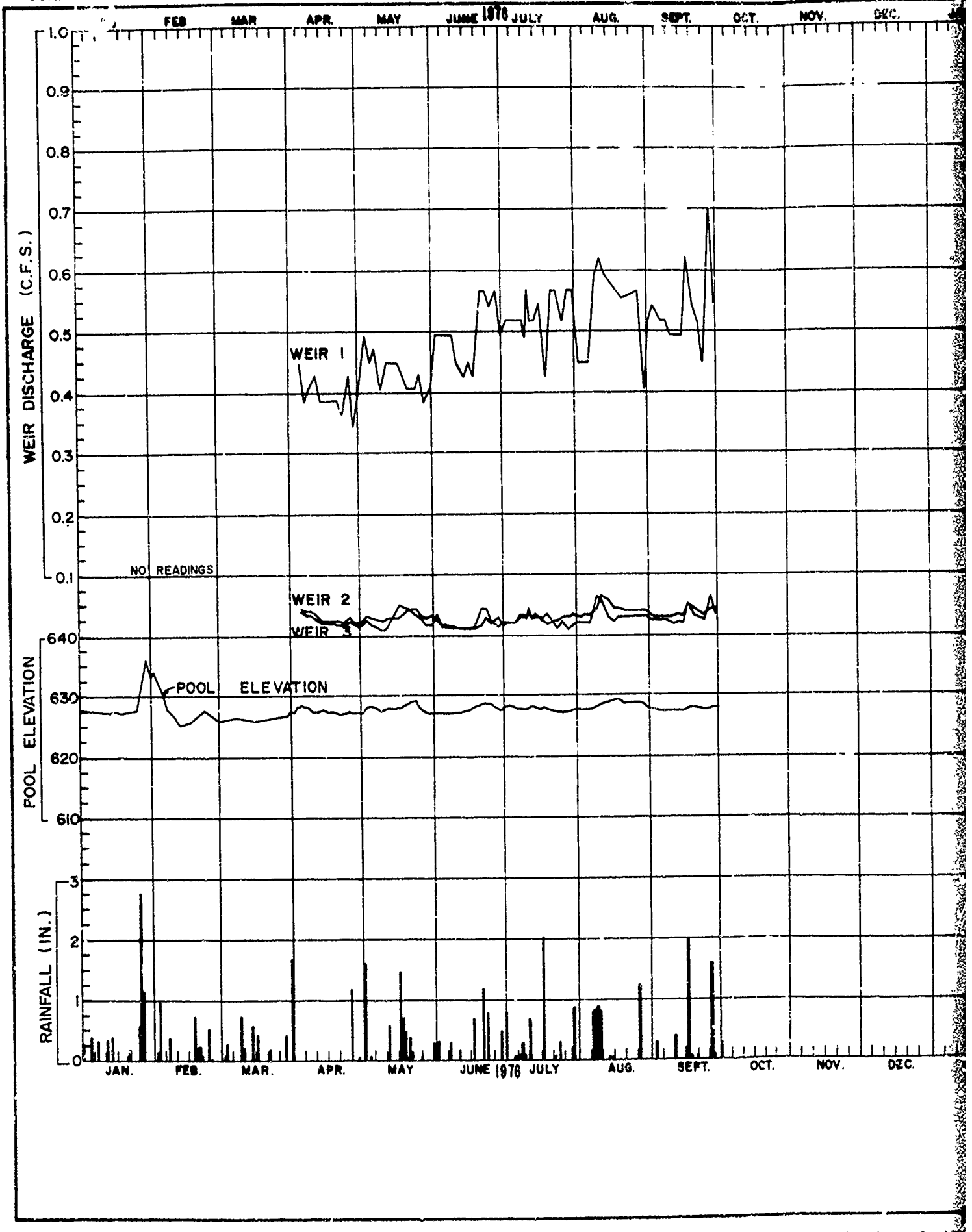
LEHIGH RIVER BASIN
POHOPOCO CREEK, PENNSYLVANIA

BELTZVILLE DAM & RESERVOIR

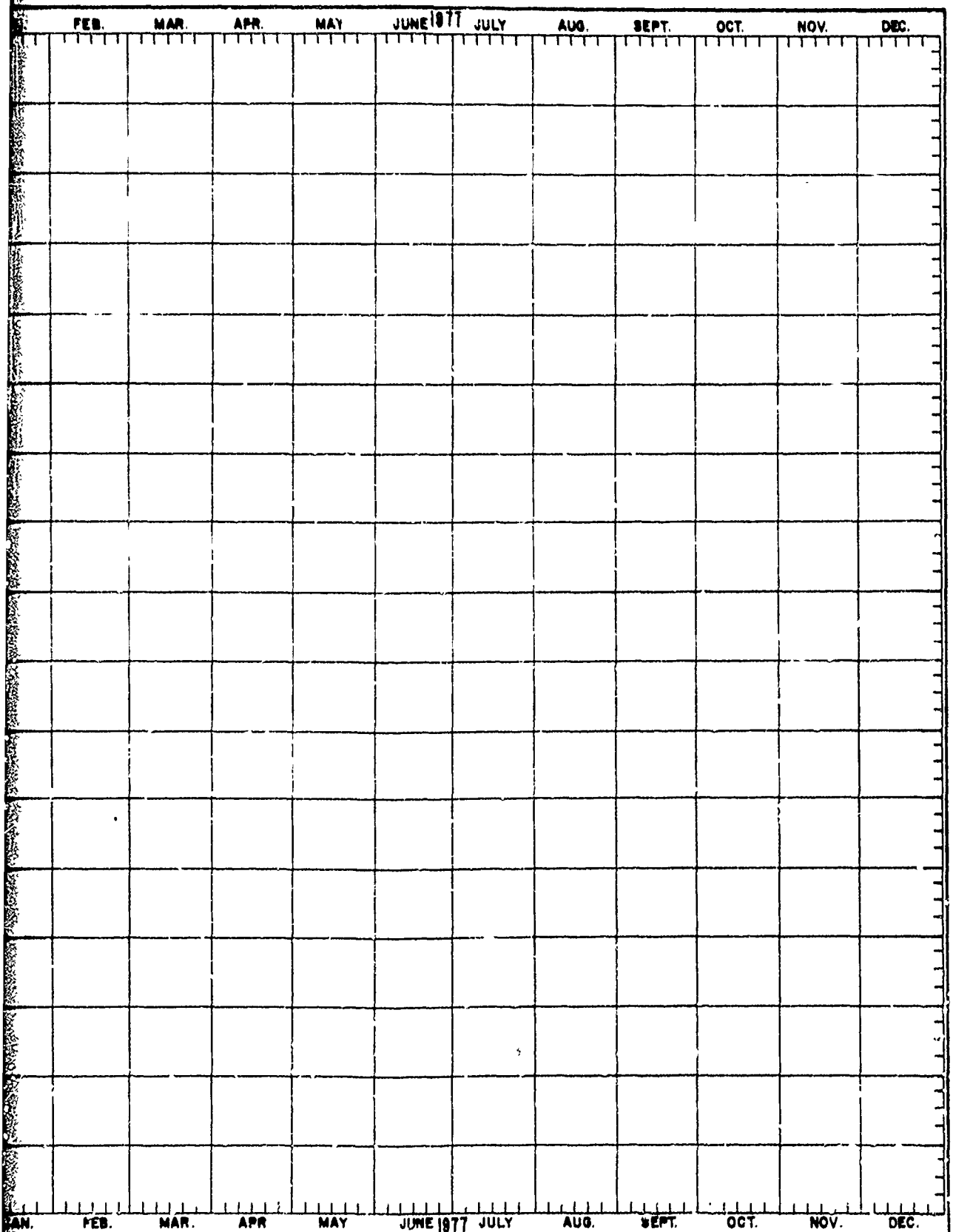
WEIR DISCHARGE

PLATE 6

CORPS OF ENGINEERS



U.S. ARMY



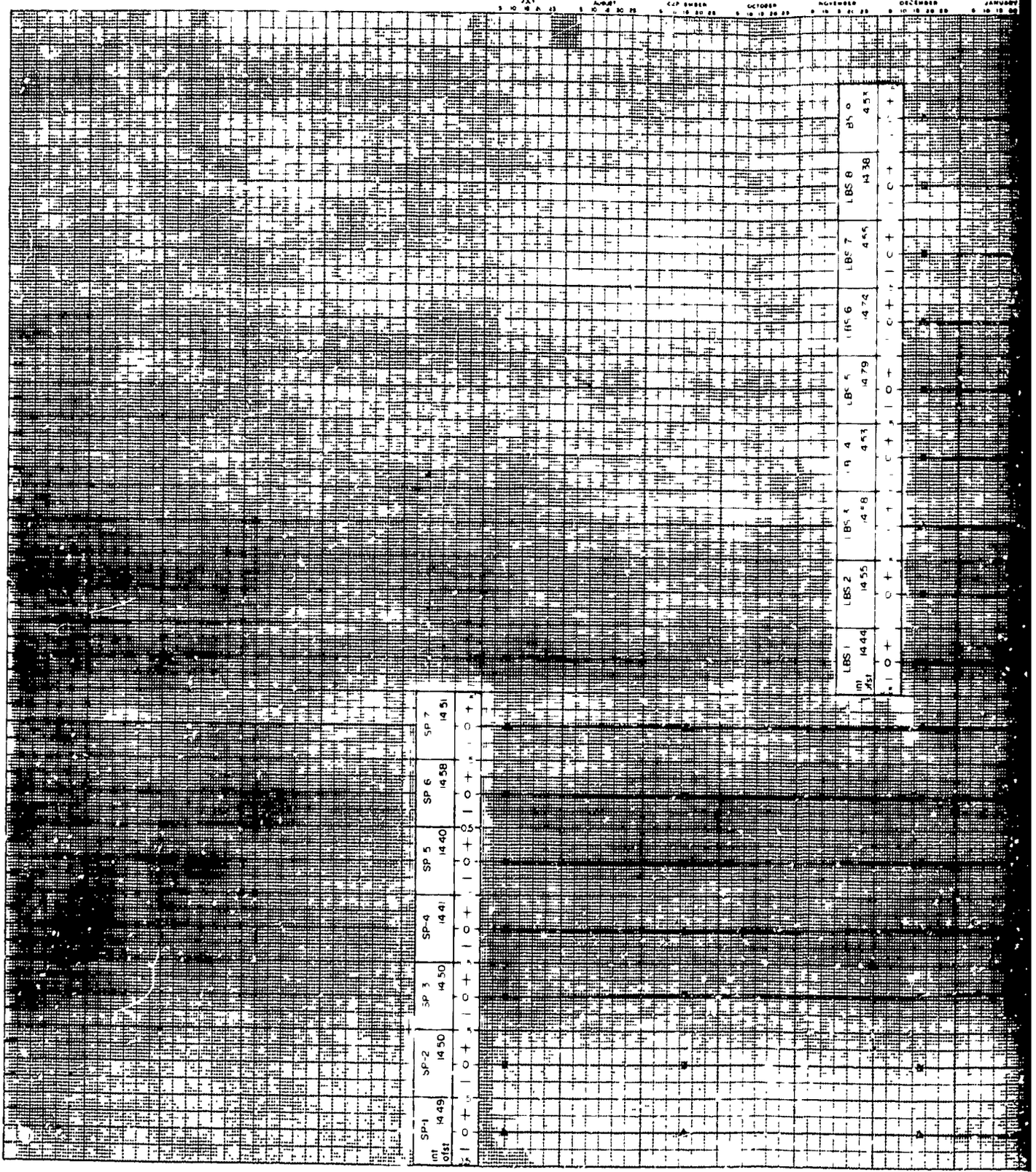
LEHIGH RIVER BASIN
POHOPOCO CREEK, PENNSYLVANIA

BELTZVILLE DAM & RESERVOIR

WEIR DISCHARGE

PLATE 7

1970



LEGEND

Surface settlement pipe number

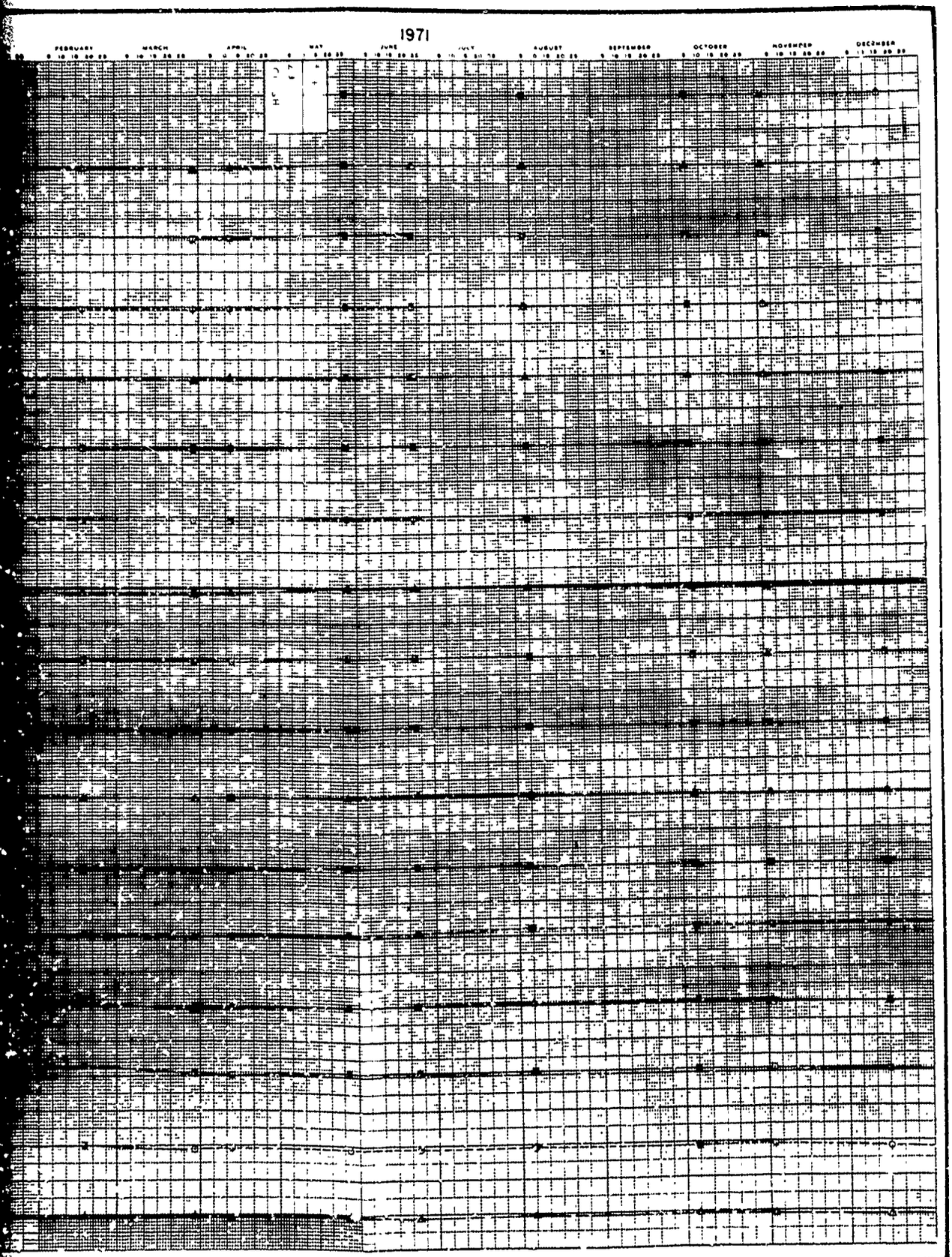
SP 1
1400
int
ofst

0.5
0
-0.5

Lateral move

Lateral move

SCALE 1"=1'



movement in upstream direction

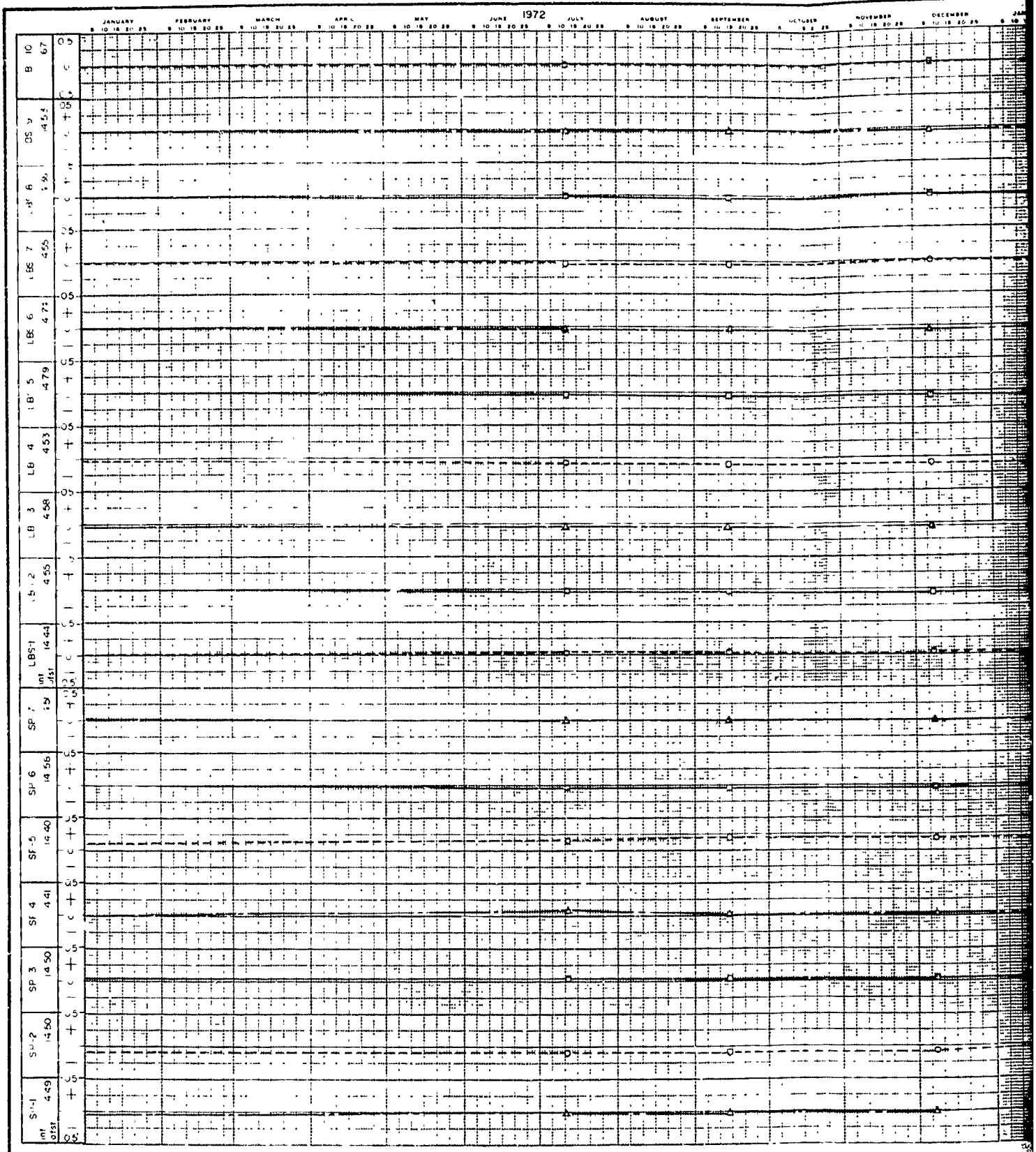
initial position

movement in downstream direction

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
SURFACE SETTLEMENT PIPES
LATERAL MOVEMENT

PLATE 8

CORPS OF ENGINEERS

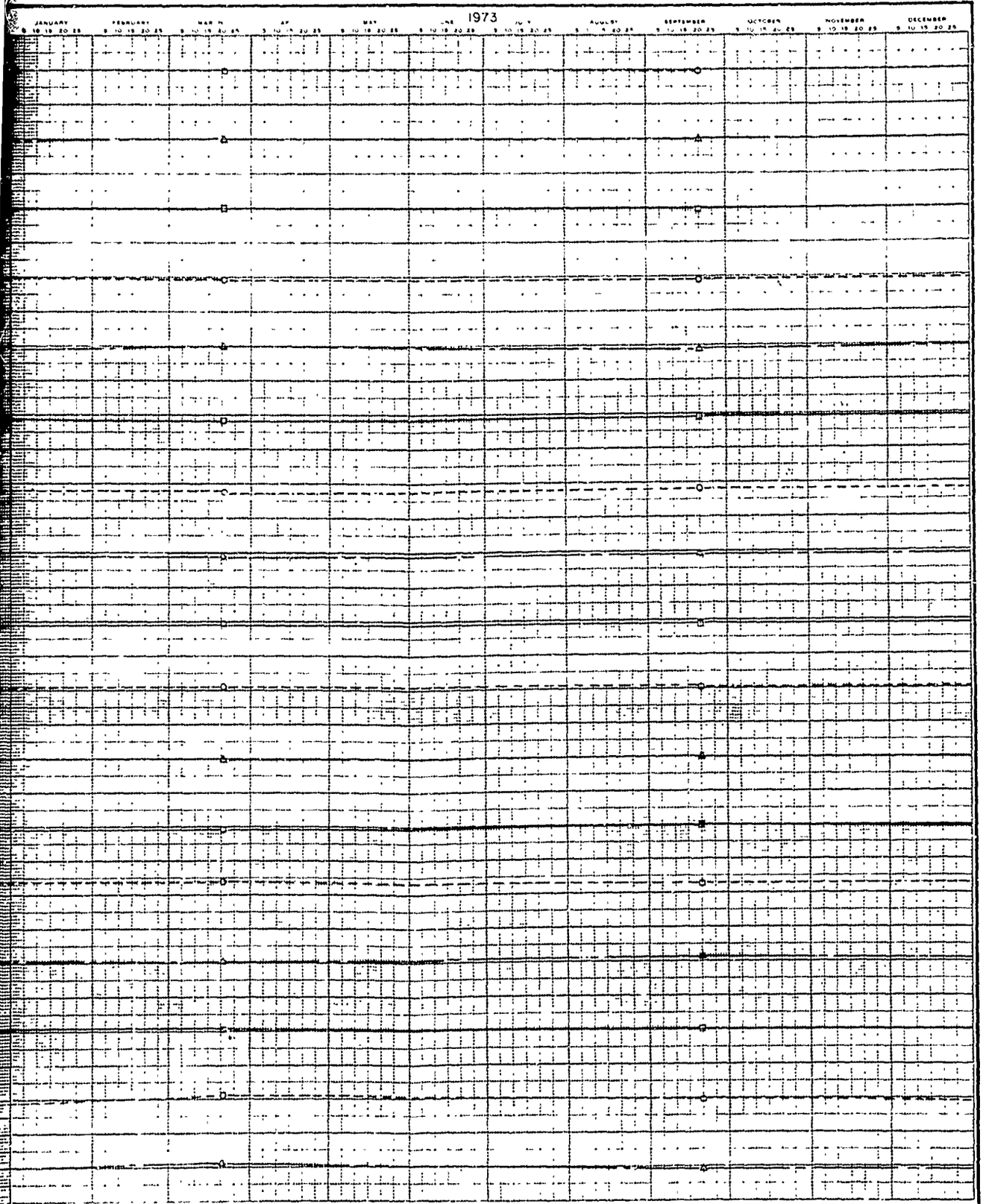


LEGEND:

Surface settlement pipe number

SCALE 1"=1'

U S ARMY



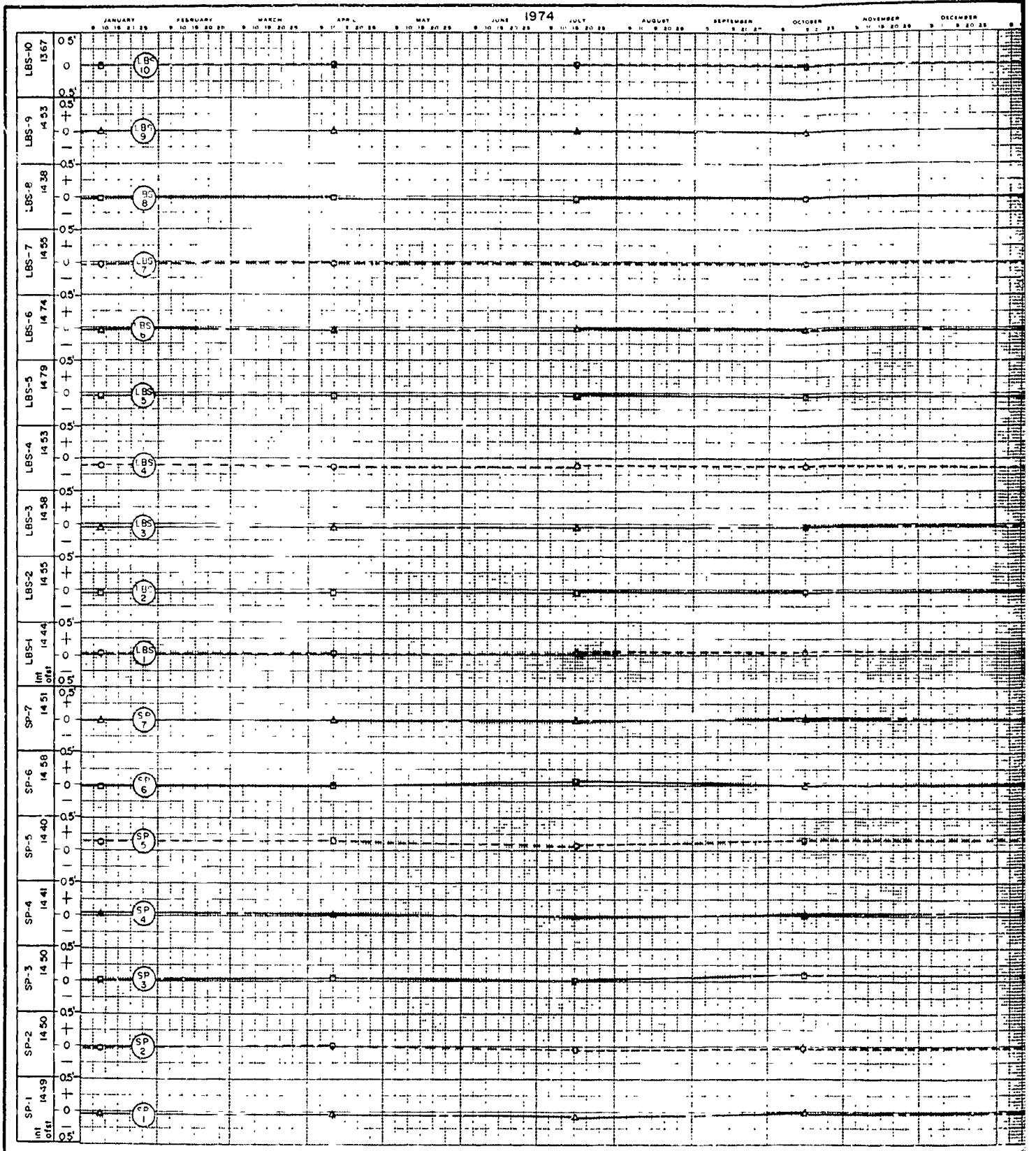
.05 Lateral movement in upstream direction
+
0 Initial position
−
.05 Lateral movement in downstream direction

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
SURFACE SETTLEMENT PIPES
LATERAL MOVEMENT

2

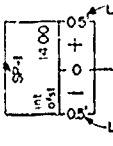
PLATE 9

CORPS OF ENGINEERS



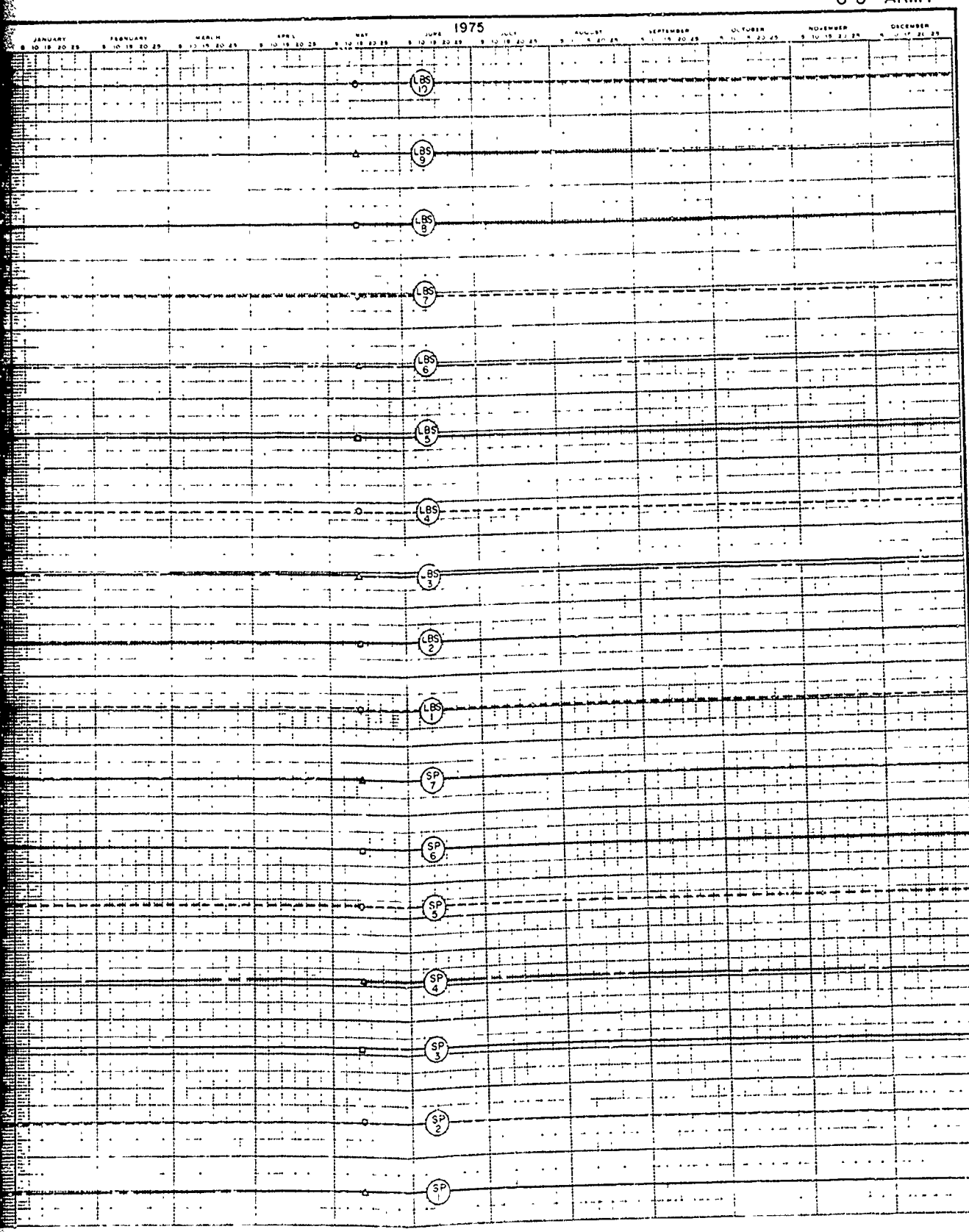
LEGEND.

Surface settlement pipe number—



SCALE 1"=1'

U S ARMY



Lateral movement in upstream direction

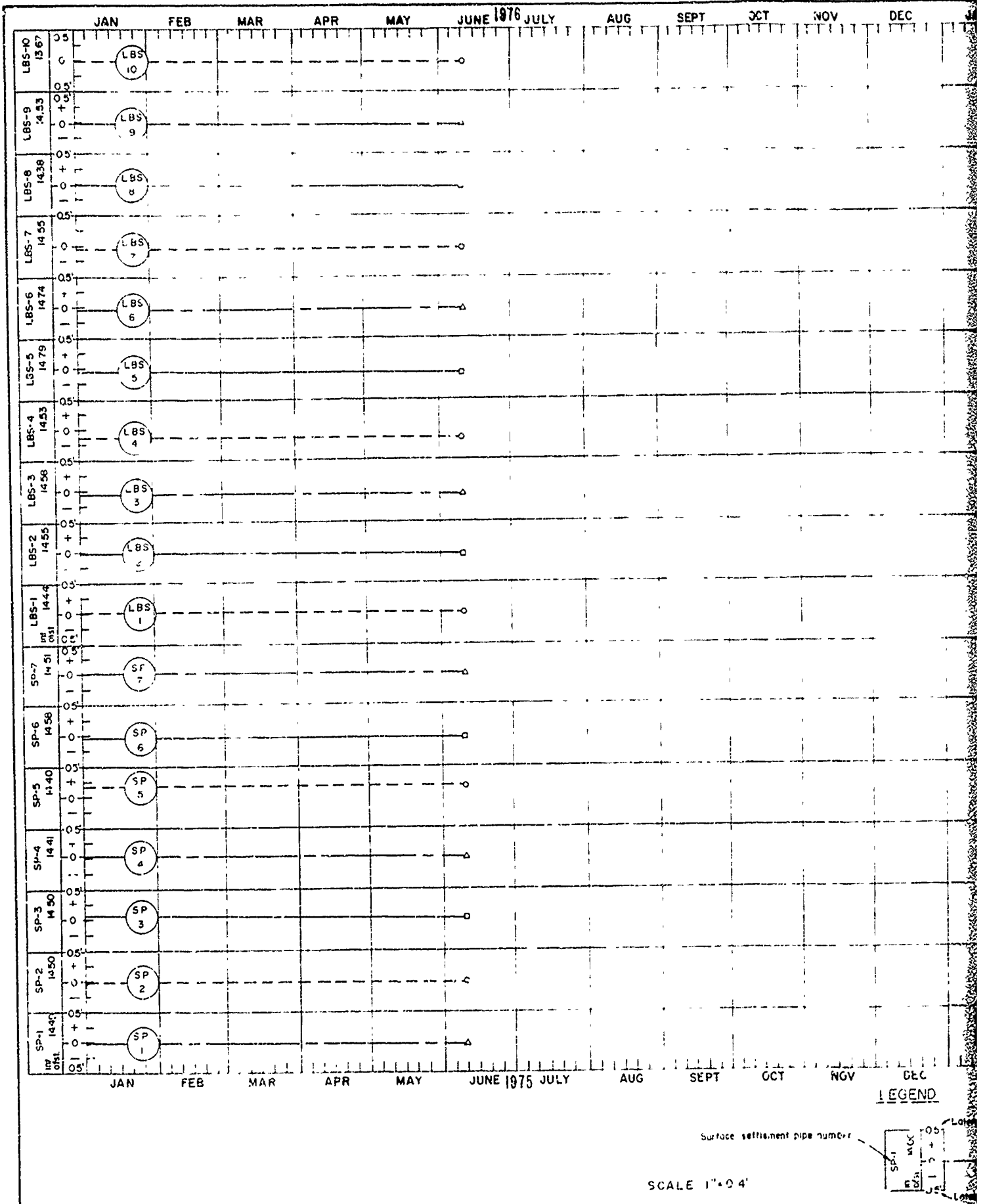
Initial position

Lateral movement in downstream direction

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
LATERAL MOVEMENT

PLATE 10

CORPS OF ENGINEERS

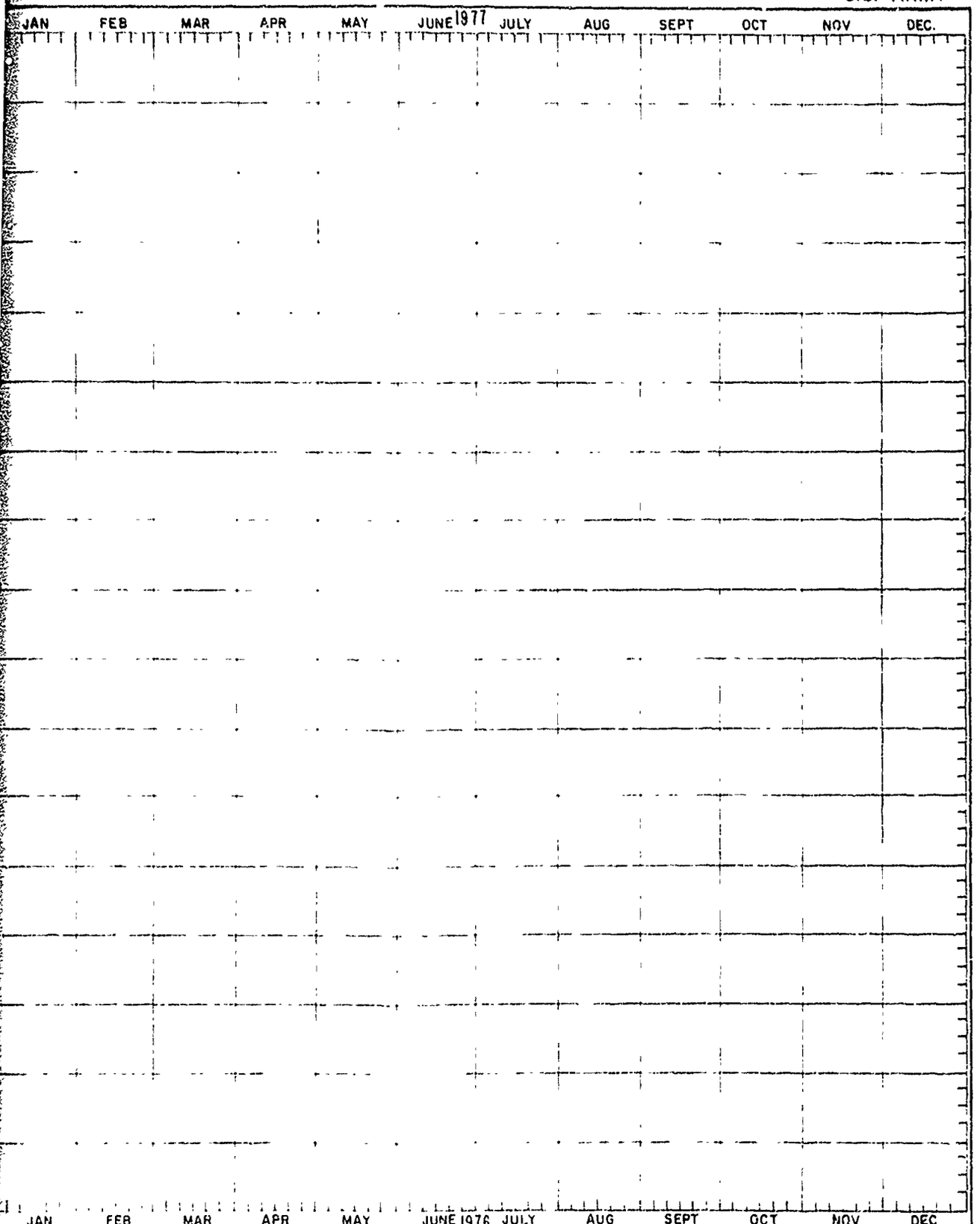


LEGEND

Surface settlement pipe number

SCALE 1"=0.4'

U.S. ARMY



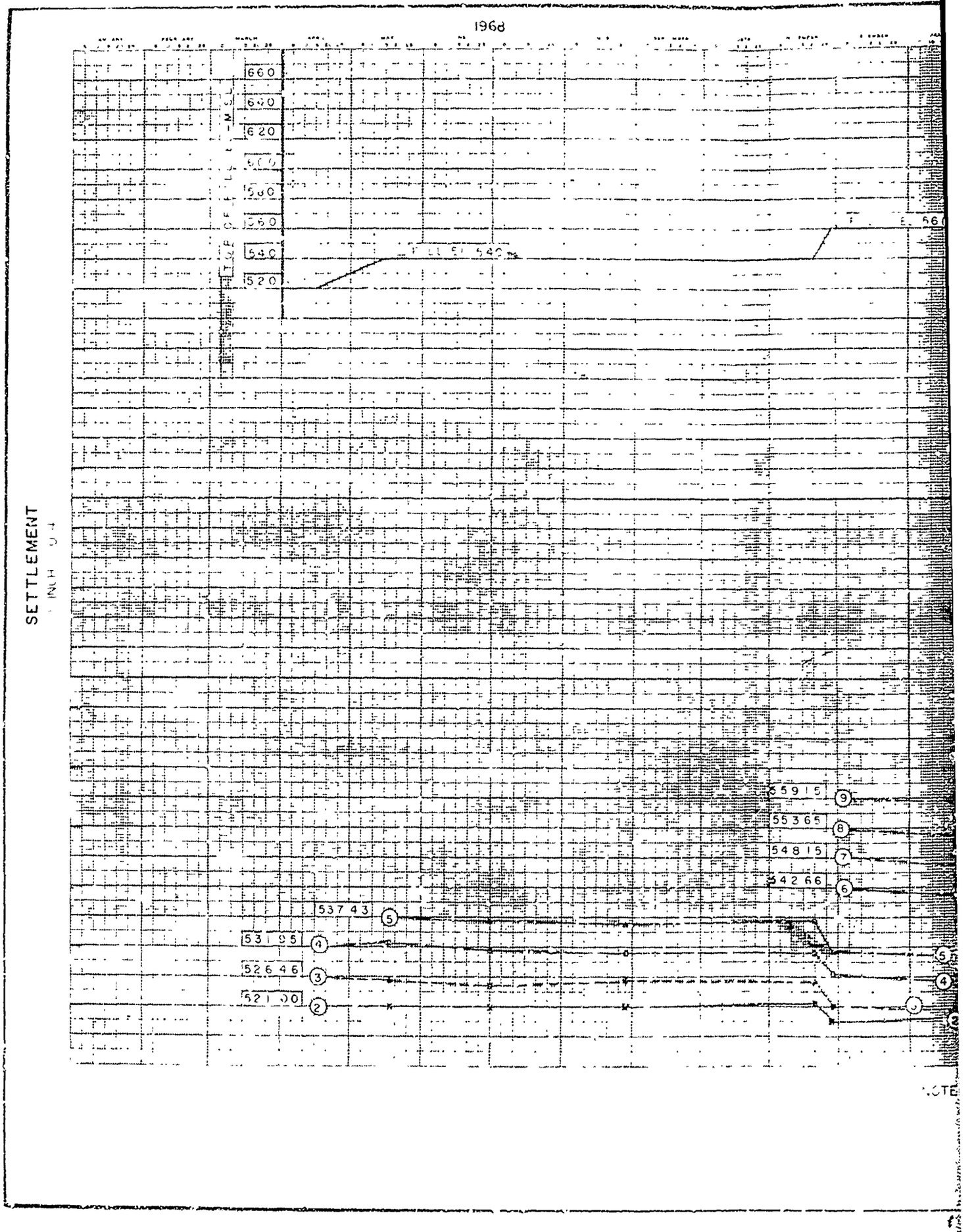
Lateral movement in upstream direction

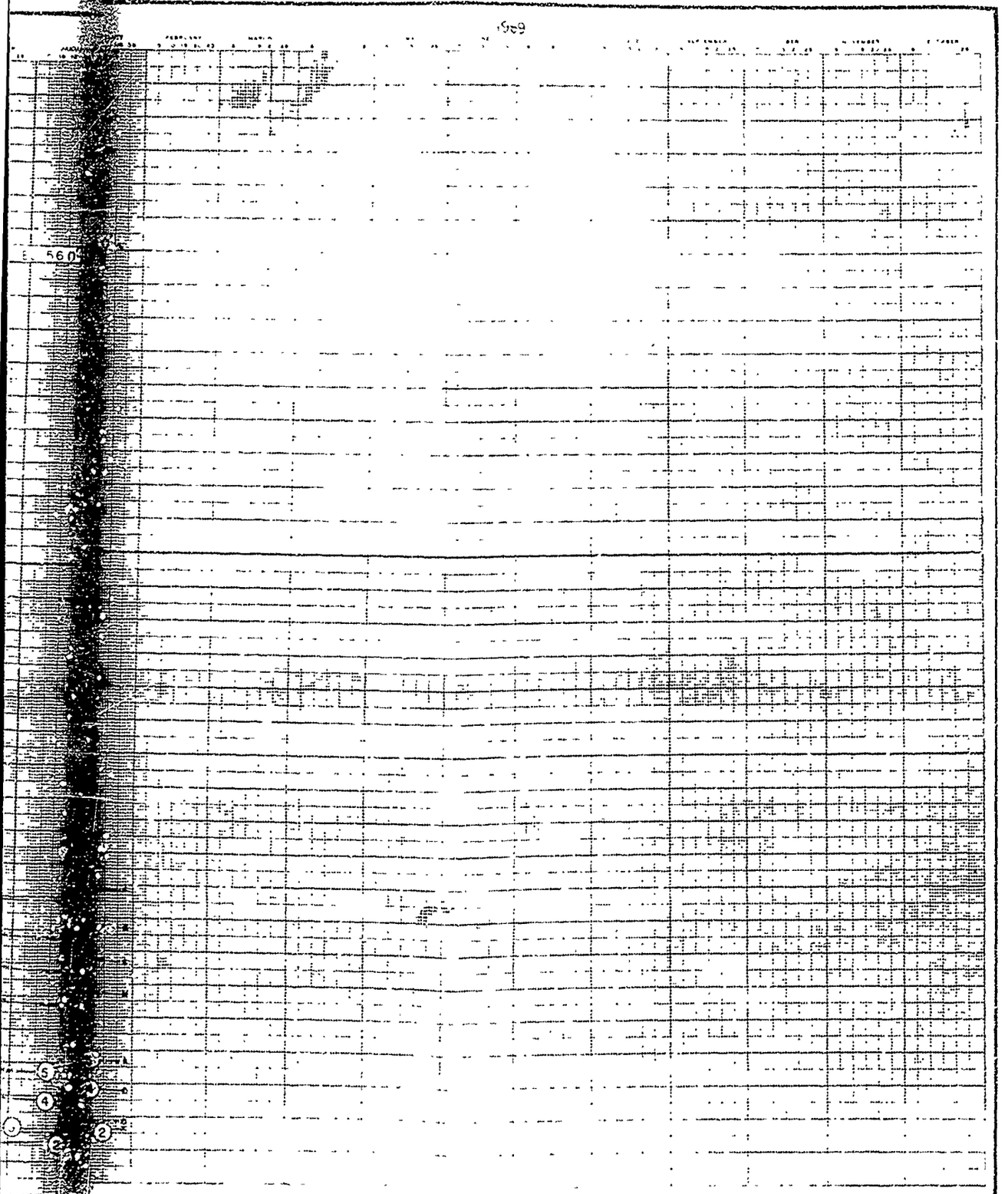
Initial position

Lateral movement in downstream direction

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
LATERAL MOVEMENT 2

PLATE 11

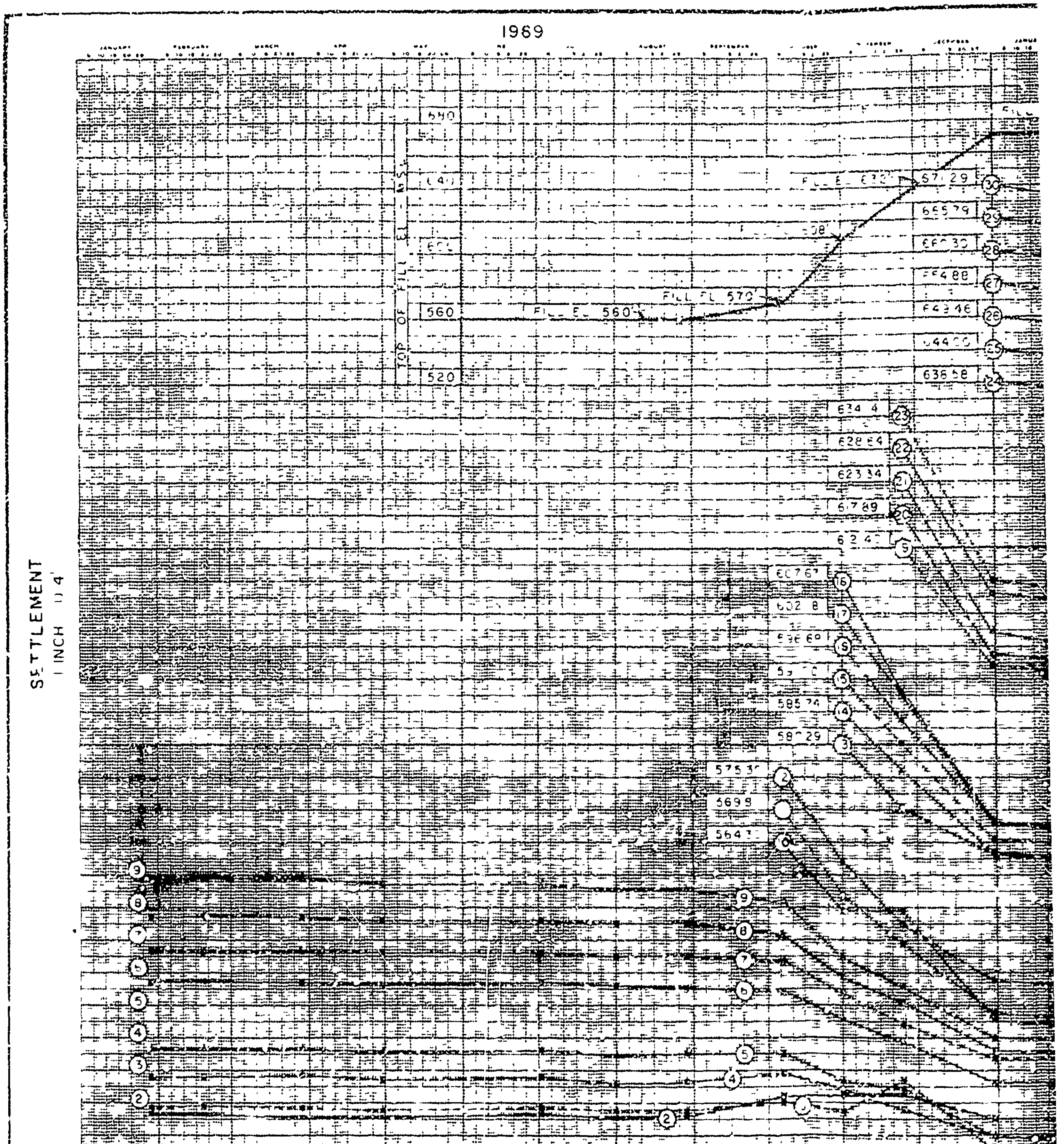

1968
660
640
620
600
580
560
540
520
TOP OF FILL - MSL
FILL @ 540
55915
55365
54815
54266
53743
53195
52646
52100
SETTLEMENT



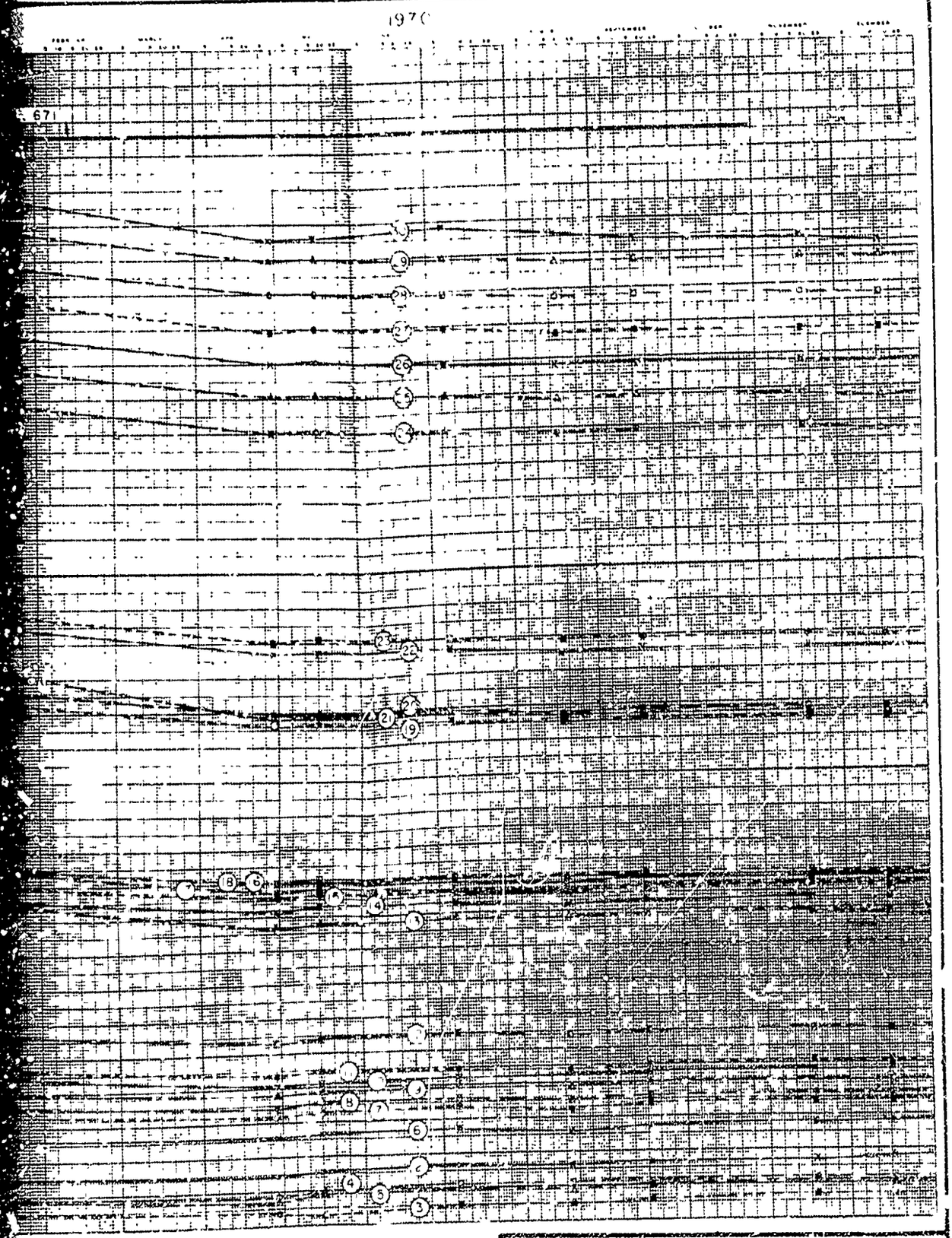
Readings are plotted on plate 18

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF-92-2

PLATE 12



NOTE
56
EL

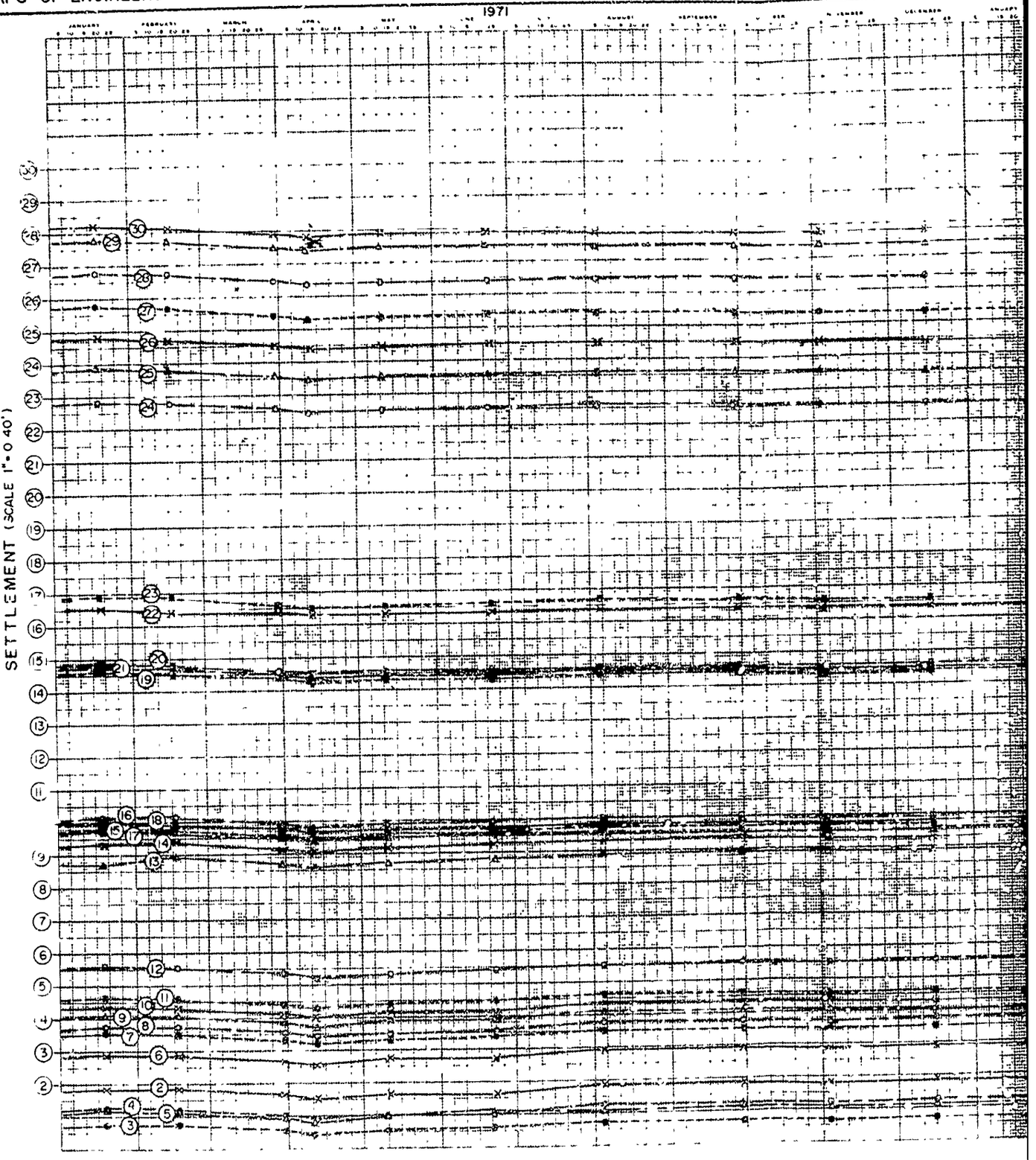


E.
56630 ig - INITIALLY INSTALLED BOTTOM
ELEVATION FOR CASING #10

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF - 92 - 2 1969 - 1970

PLATE 13

CORPS OF ENGINEERS



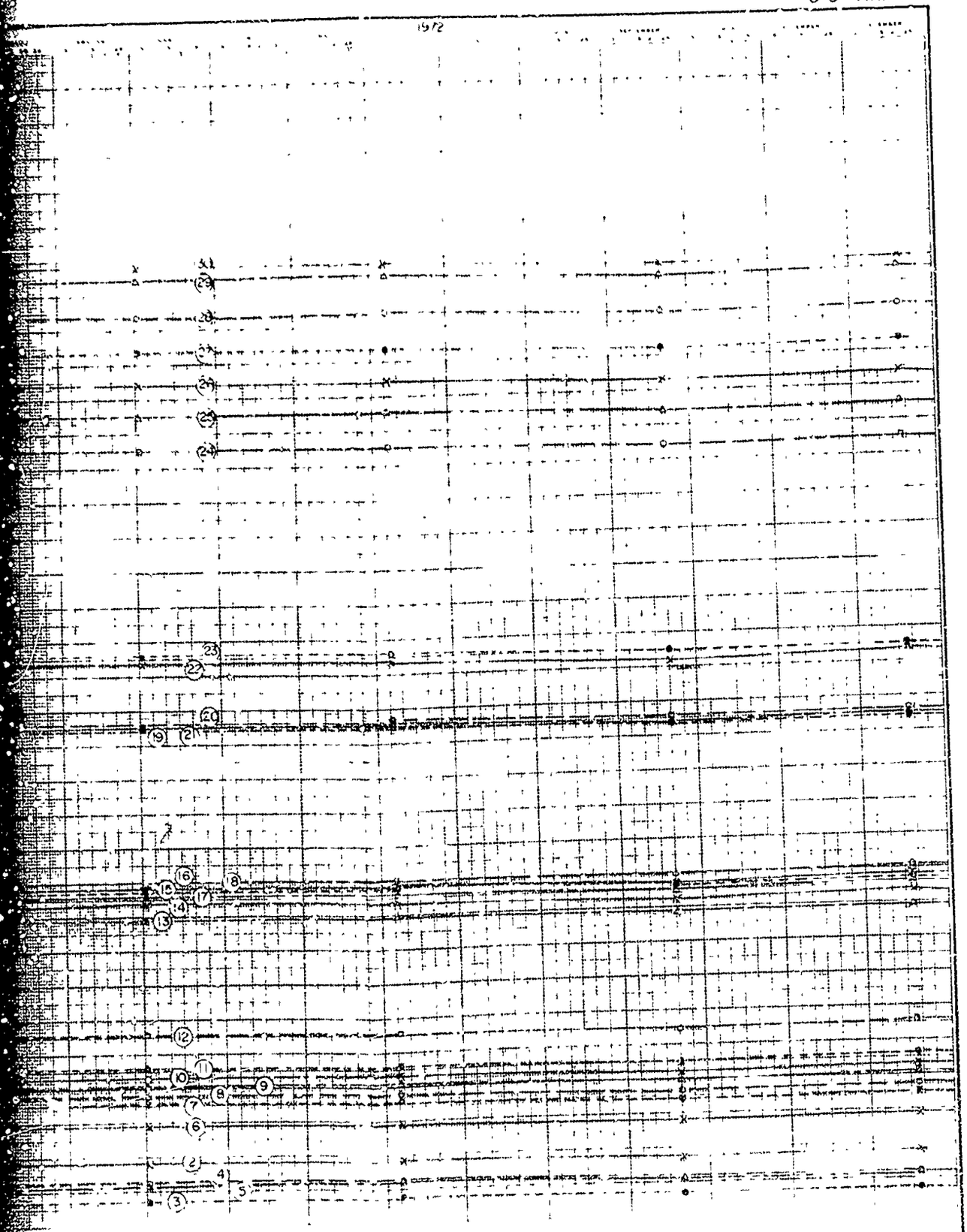
NOTE

Initial datum for settlement of section casing (2)

(2) ——— ——— ———

Measured settlement in section casing (2)

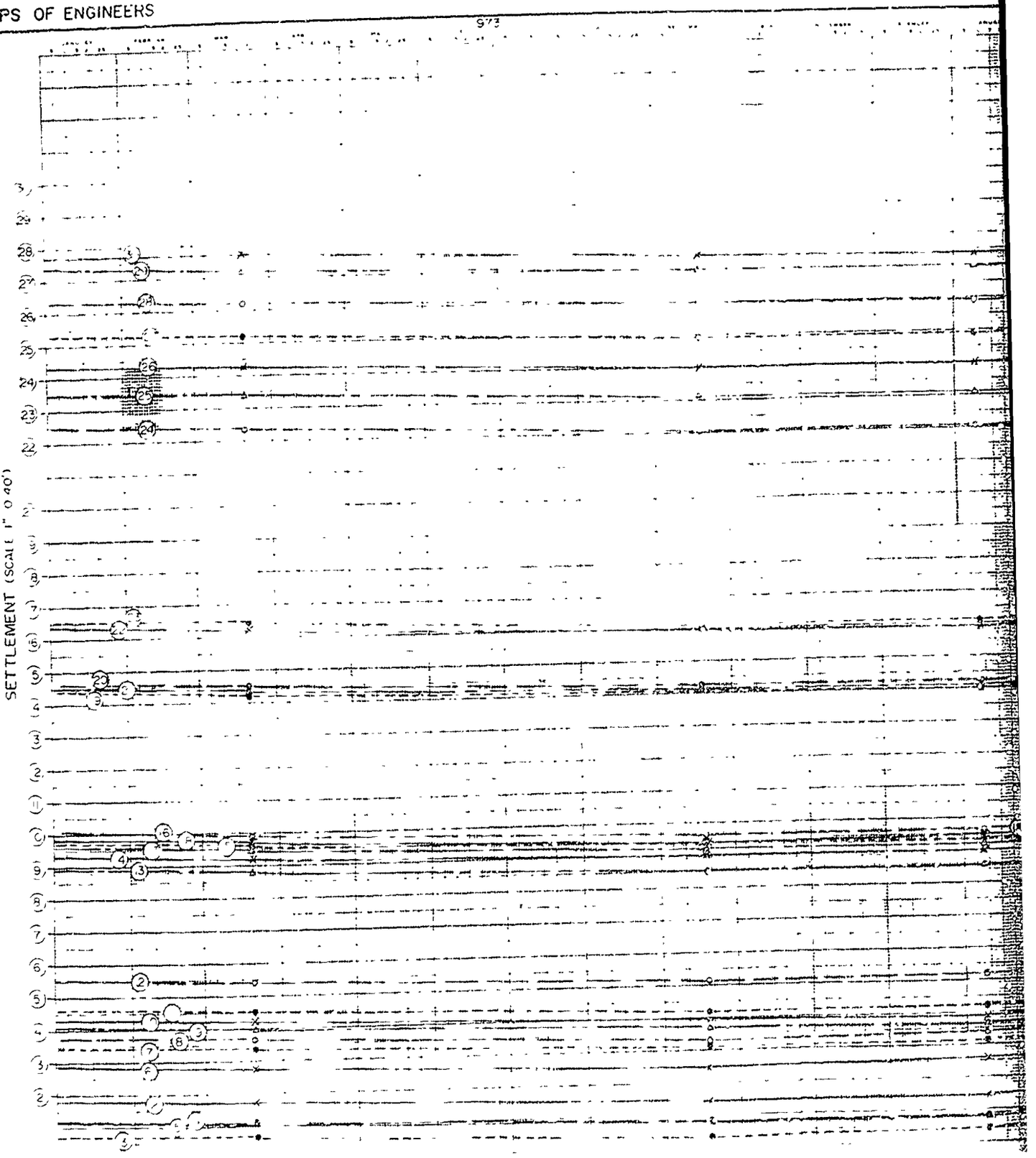
U S ARMY



LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF - 92 - 2 1971 - 1972

PLATE 14

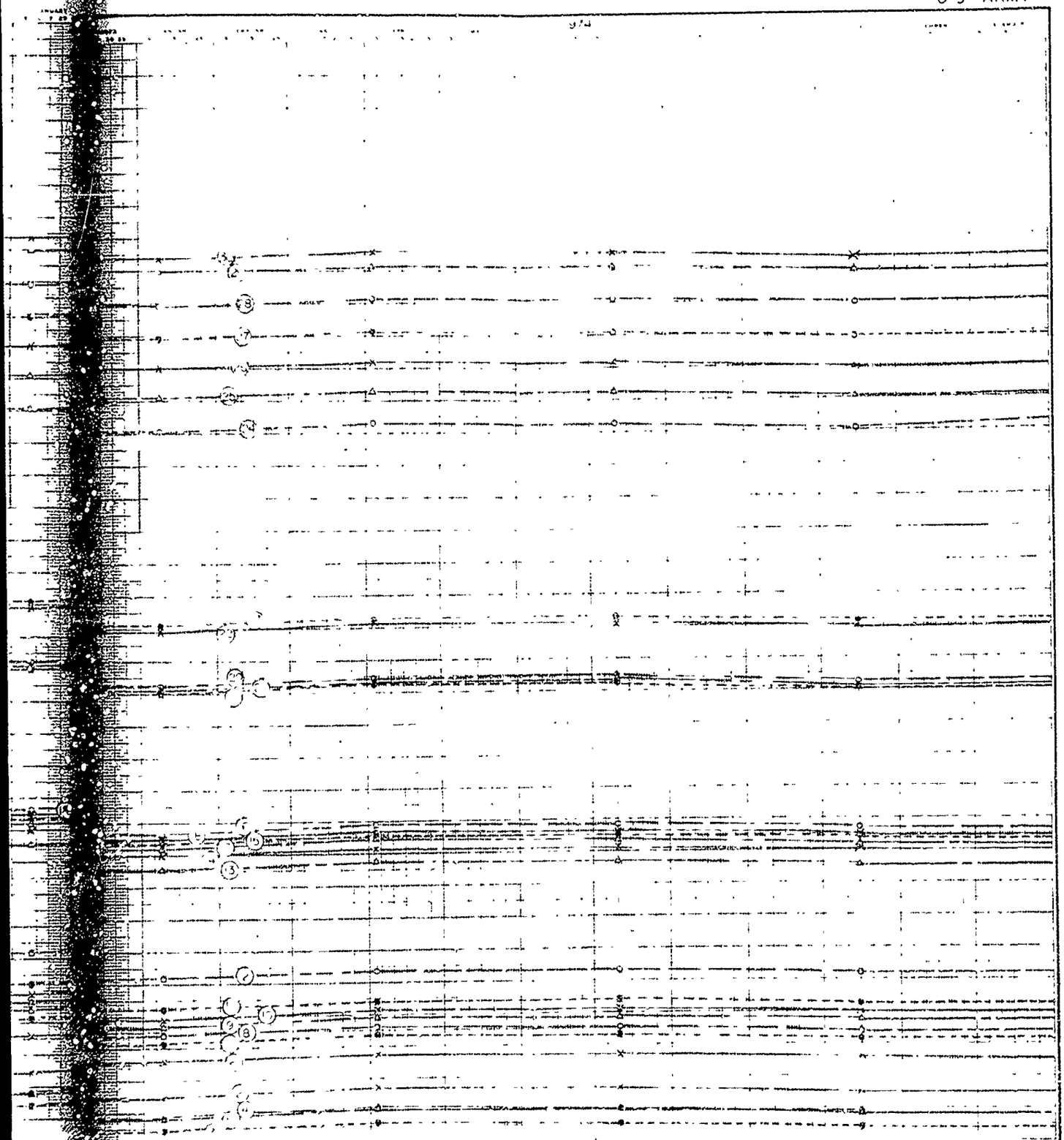
CORPS OF ENGINEERS



NOTE

- Initial datum for settlement of section using ⊂
- 2
- ⊂Measured settlement of section using ⊂

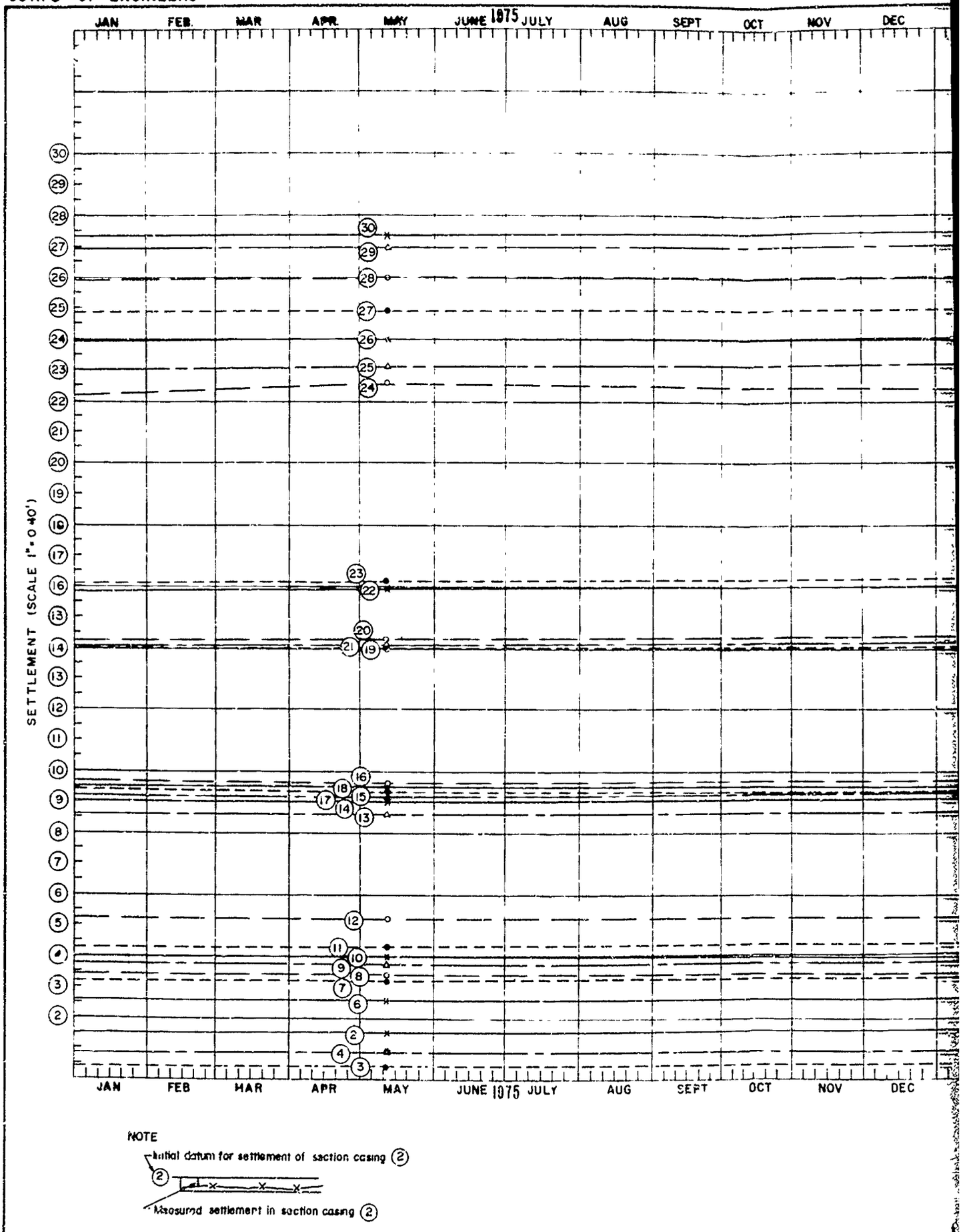
U S ARMY



LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF - 92 - 2 1973-1974

PLATE 15

CORPS OF ENGINEERS

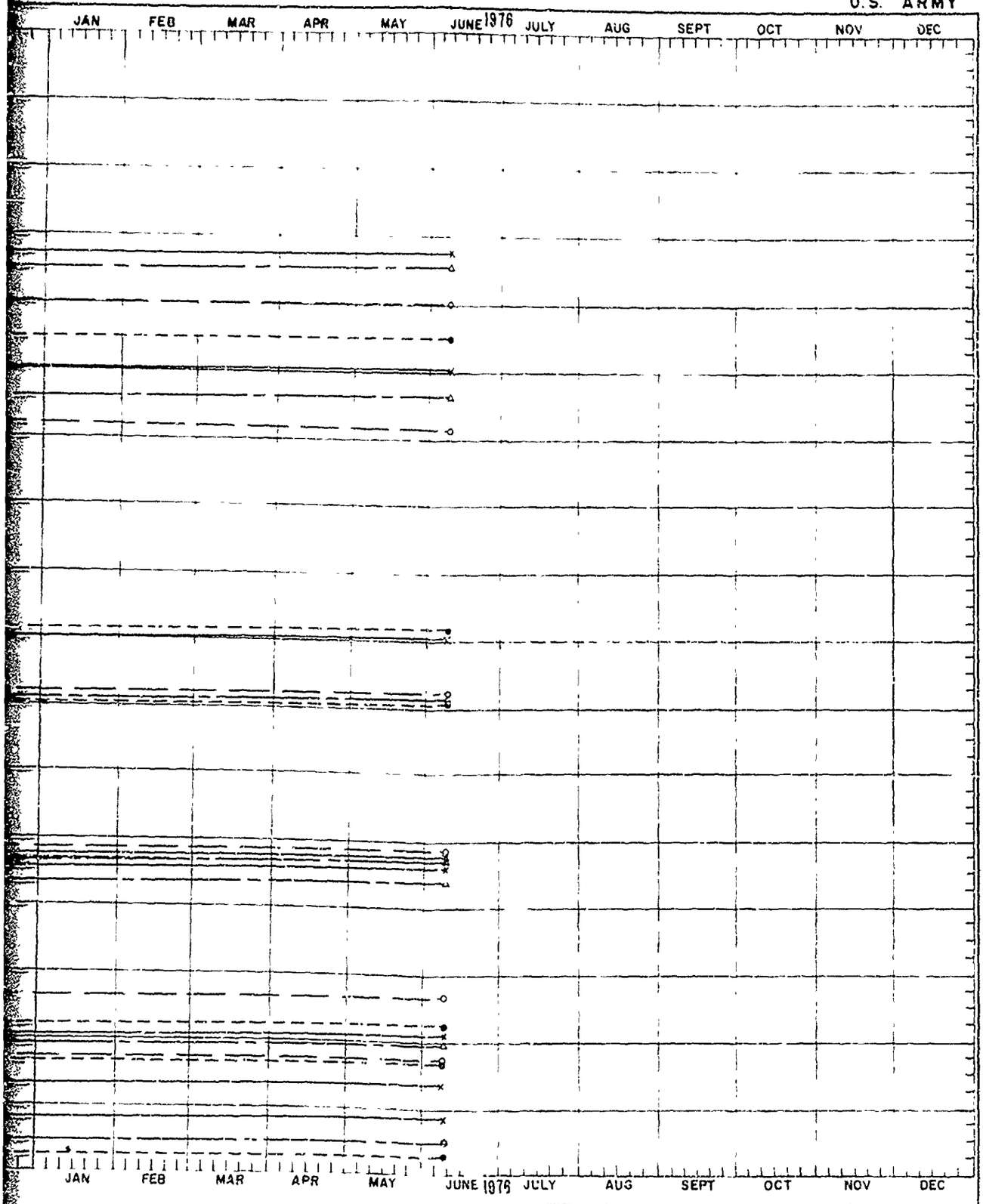


NOTE

Initial datum for settlement of section casing (2)

Measured settlement in section casing (2)

U.S. ARMY

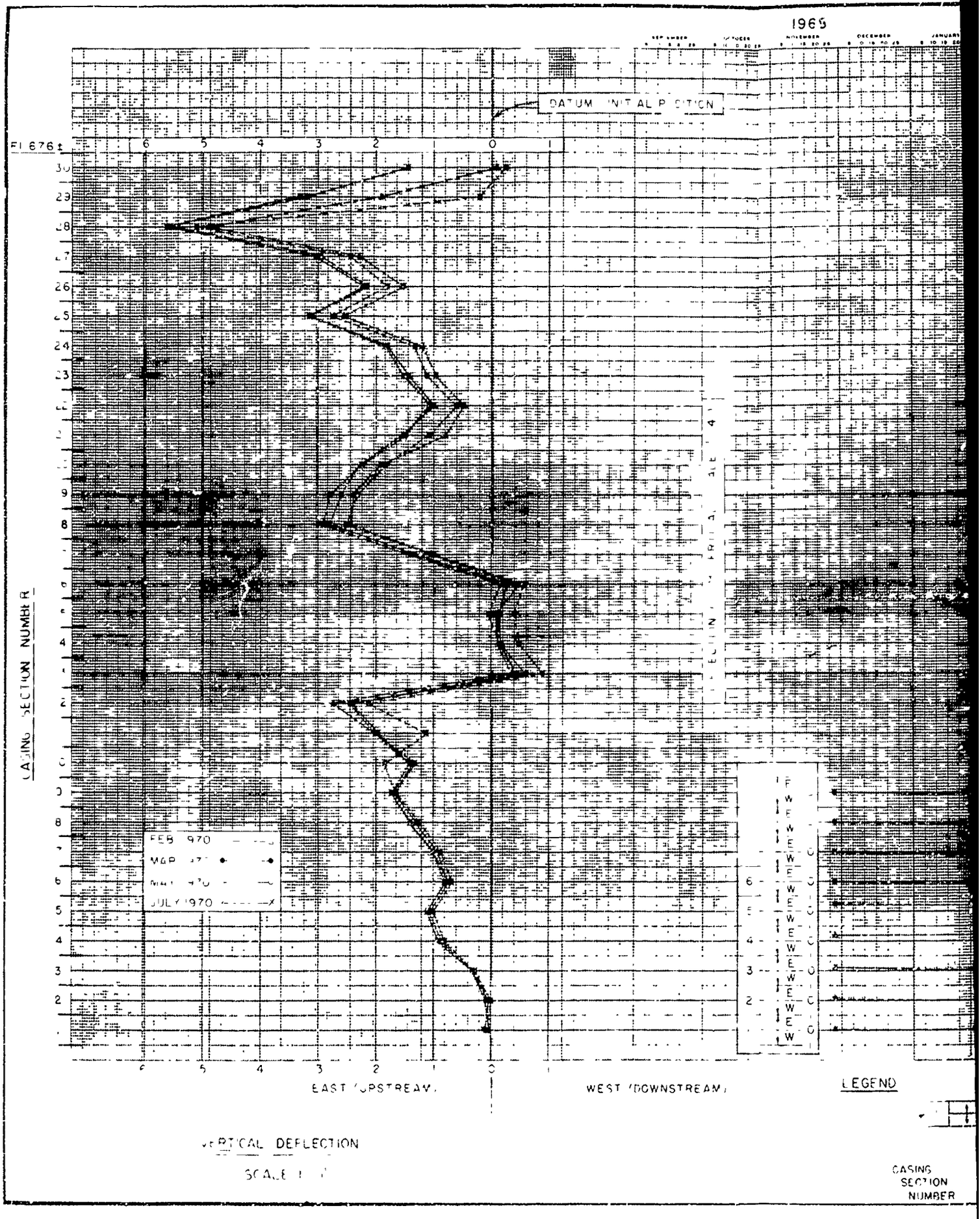


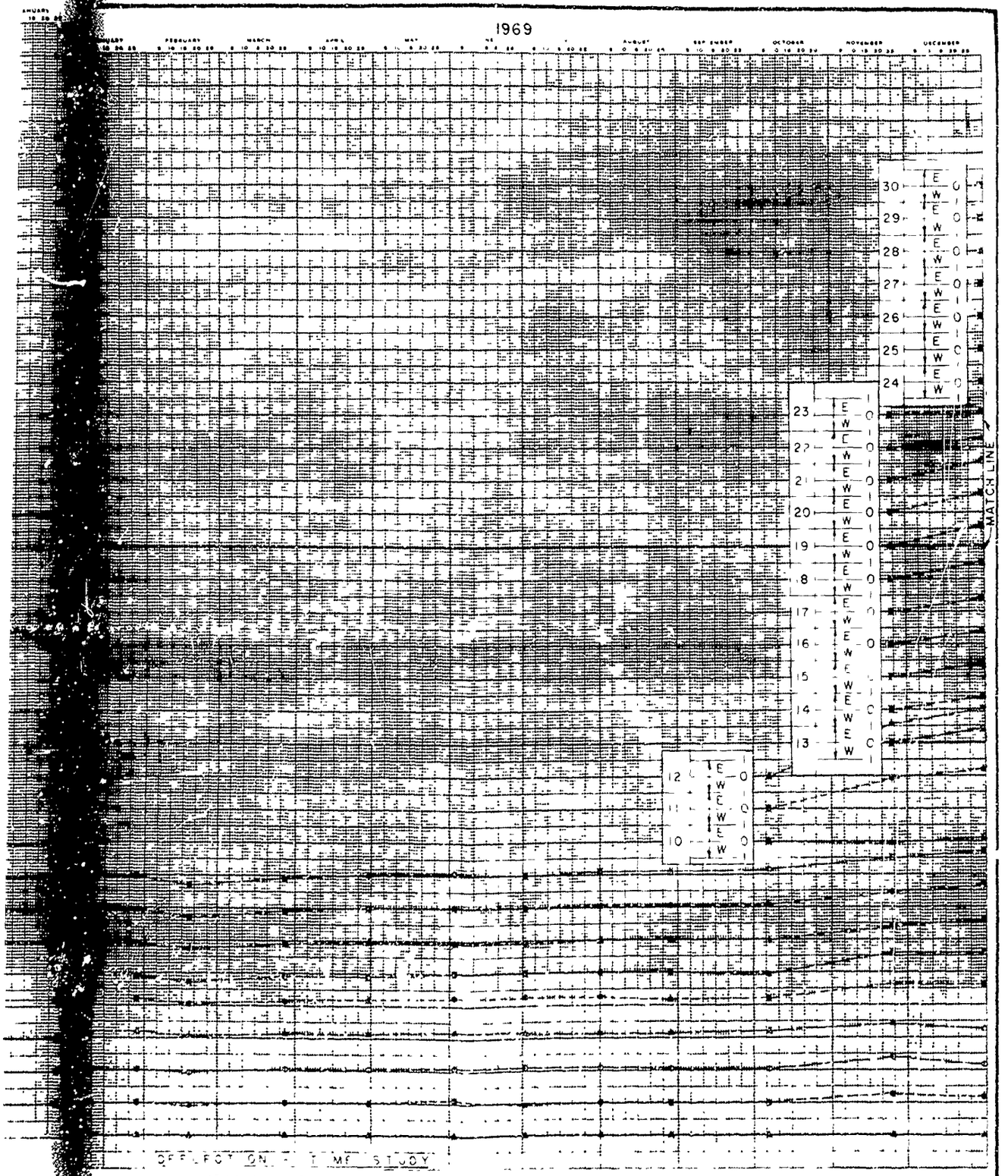
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.

BELTZVILLE LAKE
SUBSURFACE SETTLEMENT

VIF 92-2 1975 - 1976

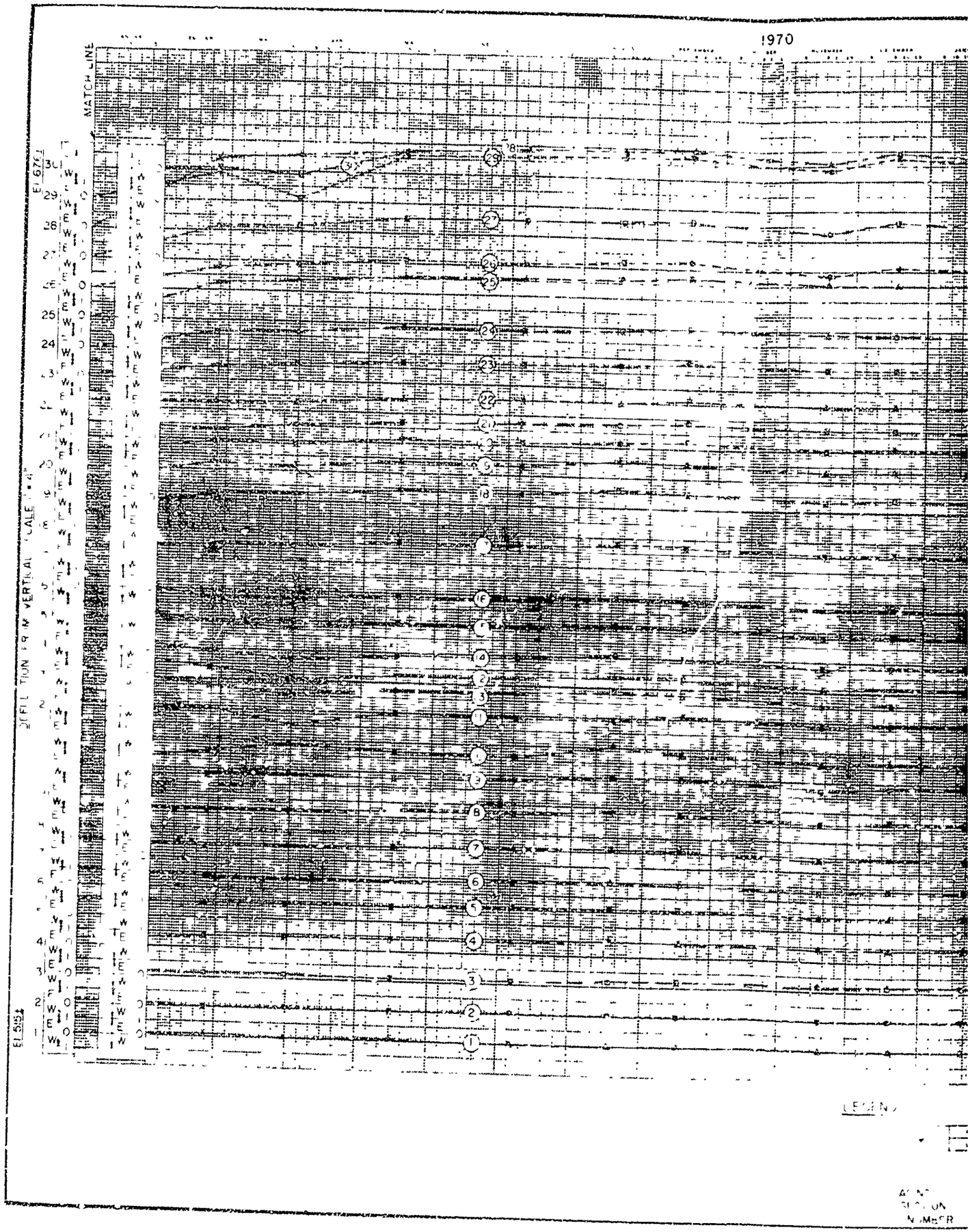
PLATE 16

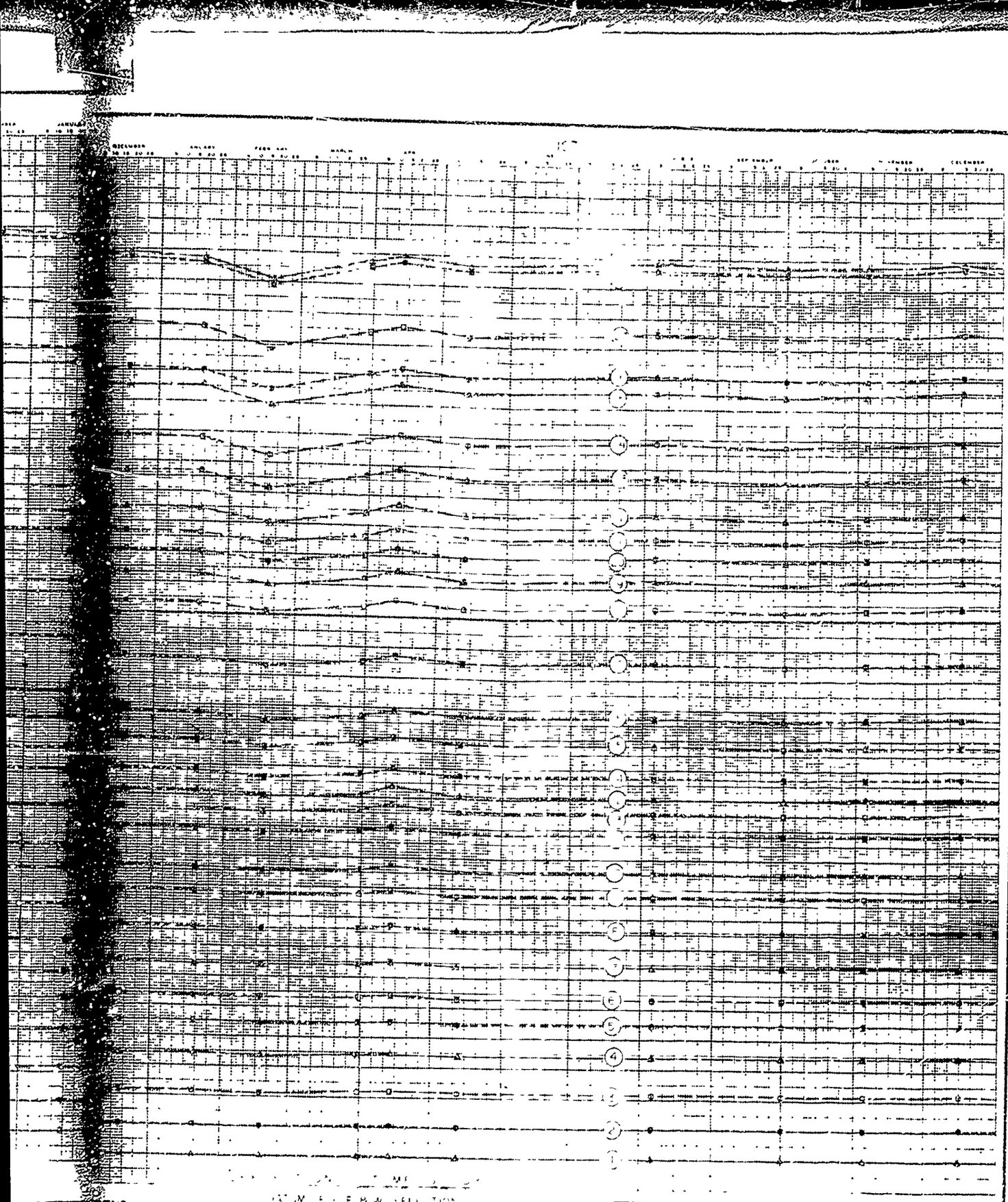

1965
DATUM INITIAL POSITION
EL 676 ±
CASING SECTION NUMBER
FEB 1970
MAR 1970
MAY 1970
JULY 1970
EAST (UPSTREAM)
WEST (DOWNSTREAM)
LEGEND
VERTICAL DEFLECTION
SCALE 1" = 1'
CASING SECTION NUMBER



LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA E & W
VIF-92-2

PLATE 17

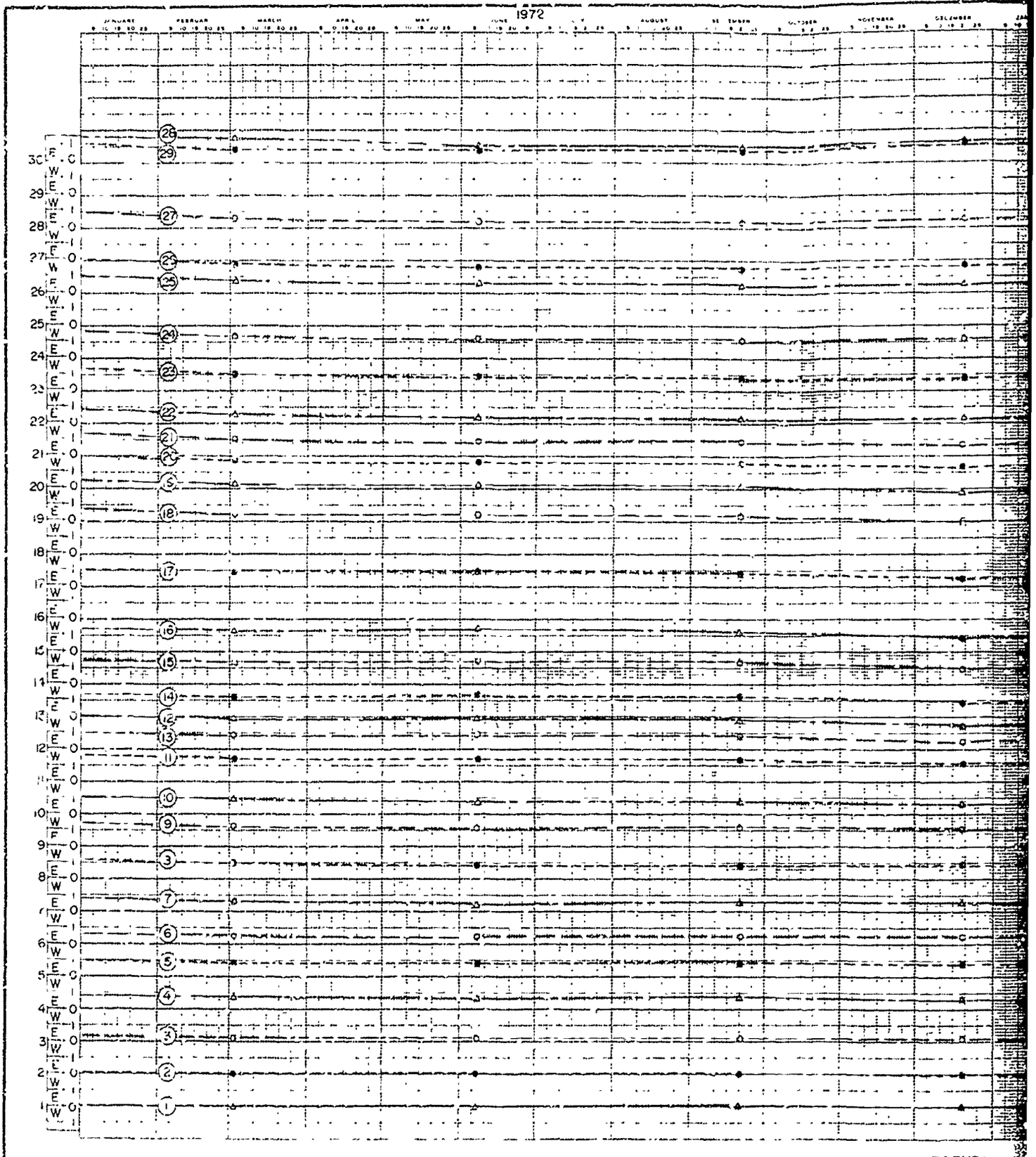

1970
MATCH LINE
EL 675
EL 595
PROFILE FROM VERTICAL SCALE 1"=4'
LEGEND
AS-
SECTION
NUMBER



LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA E & W
VIF-92-2

PLATE 18

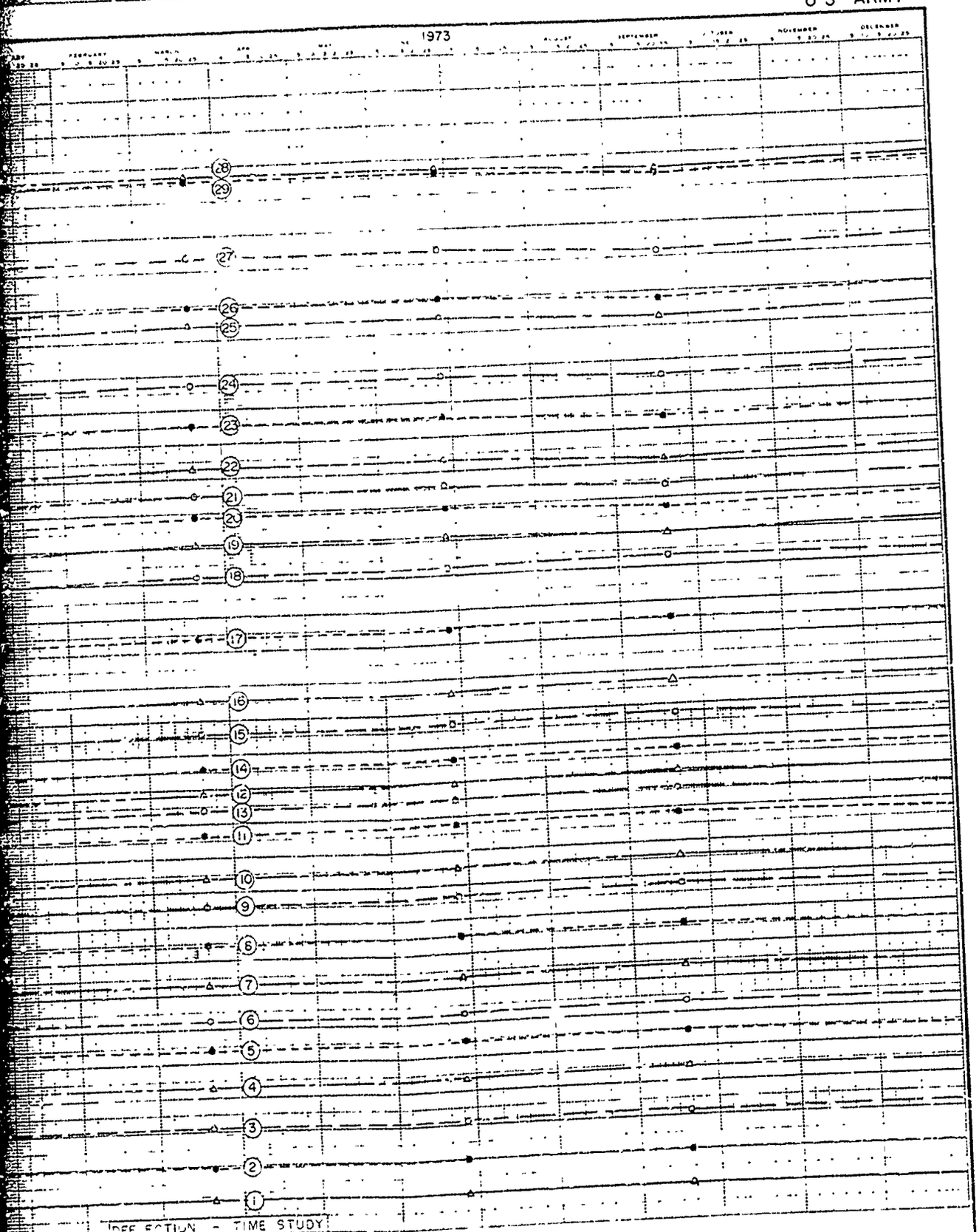
CORPS OF ENGINEERS



LEGEND

CASING
SECTIO
NUM

U S ARMY



DEFLECTION - TIME STUDY

DATUM FOR E & W DEFLECTION

LINE INDICATING DIRECTIONAL MOVEMENT WITH TIME

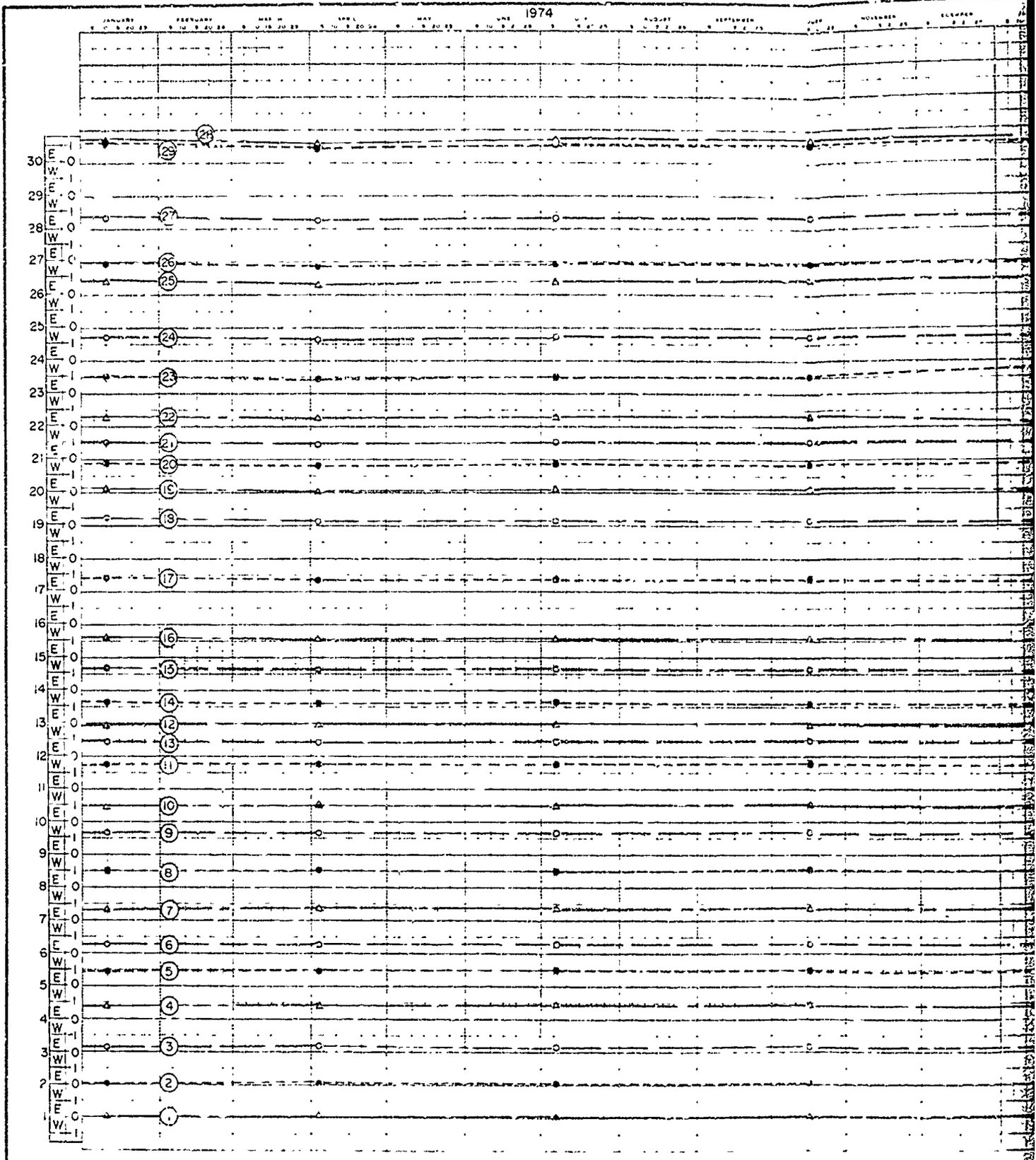
NON VERTICAL DEFLECTION IN WESTERLY DIRECTION FROM INITIAL POSITION

SING
ECTION
NUMBER

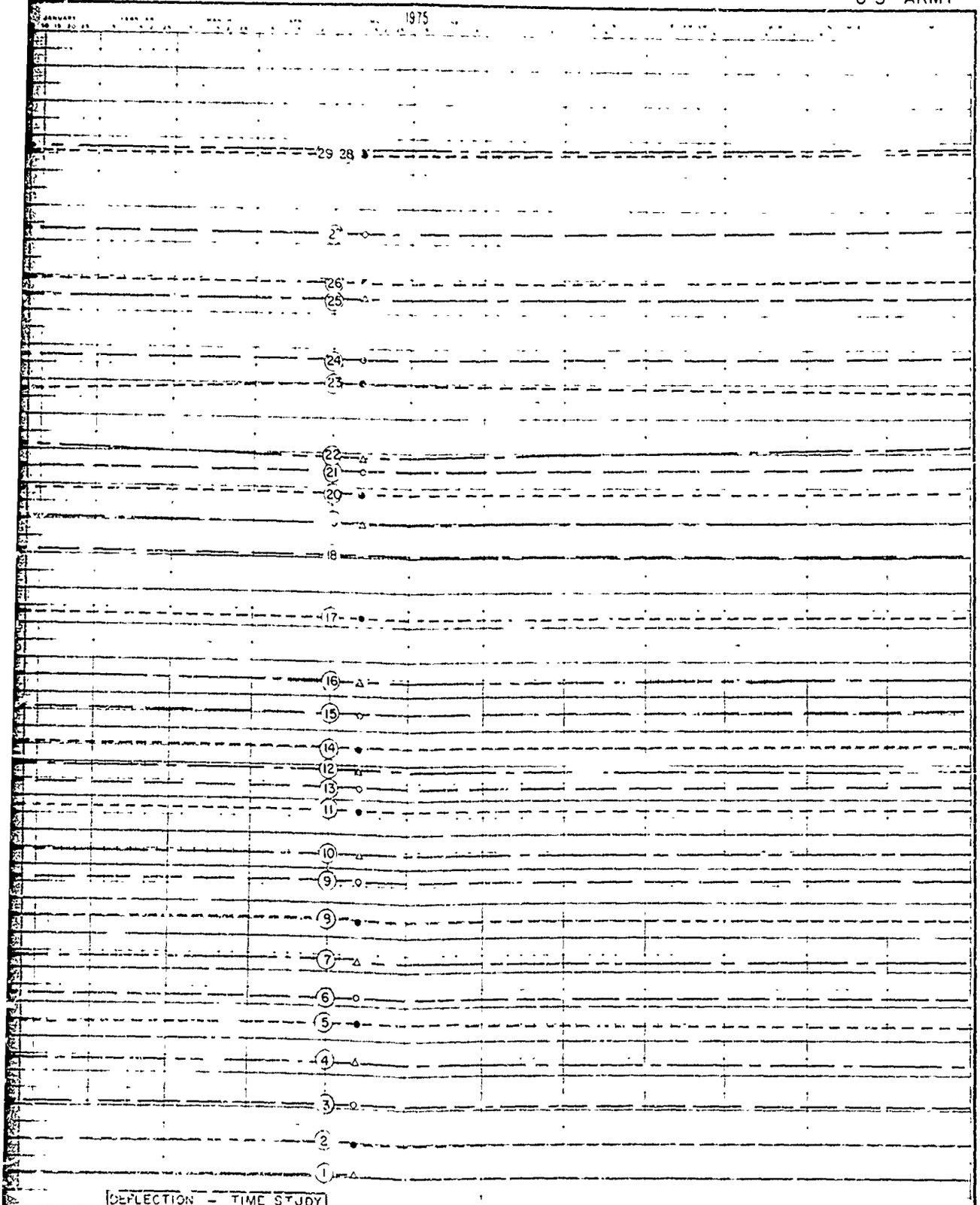
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA E & W
VIF-92-2

2 PLATE 19

CORPS OF ENGINEERS



U S ARMY



DEFLECTION - TIME STUDY

DATUM FOR E & W DEFLECTION

E
W
0

LINE INDICATING DIRECTIONAL MOVEMENT WITH TIME

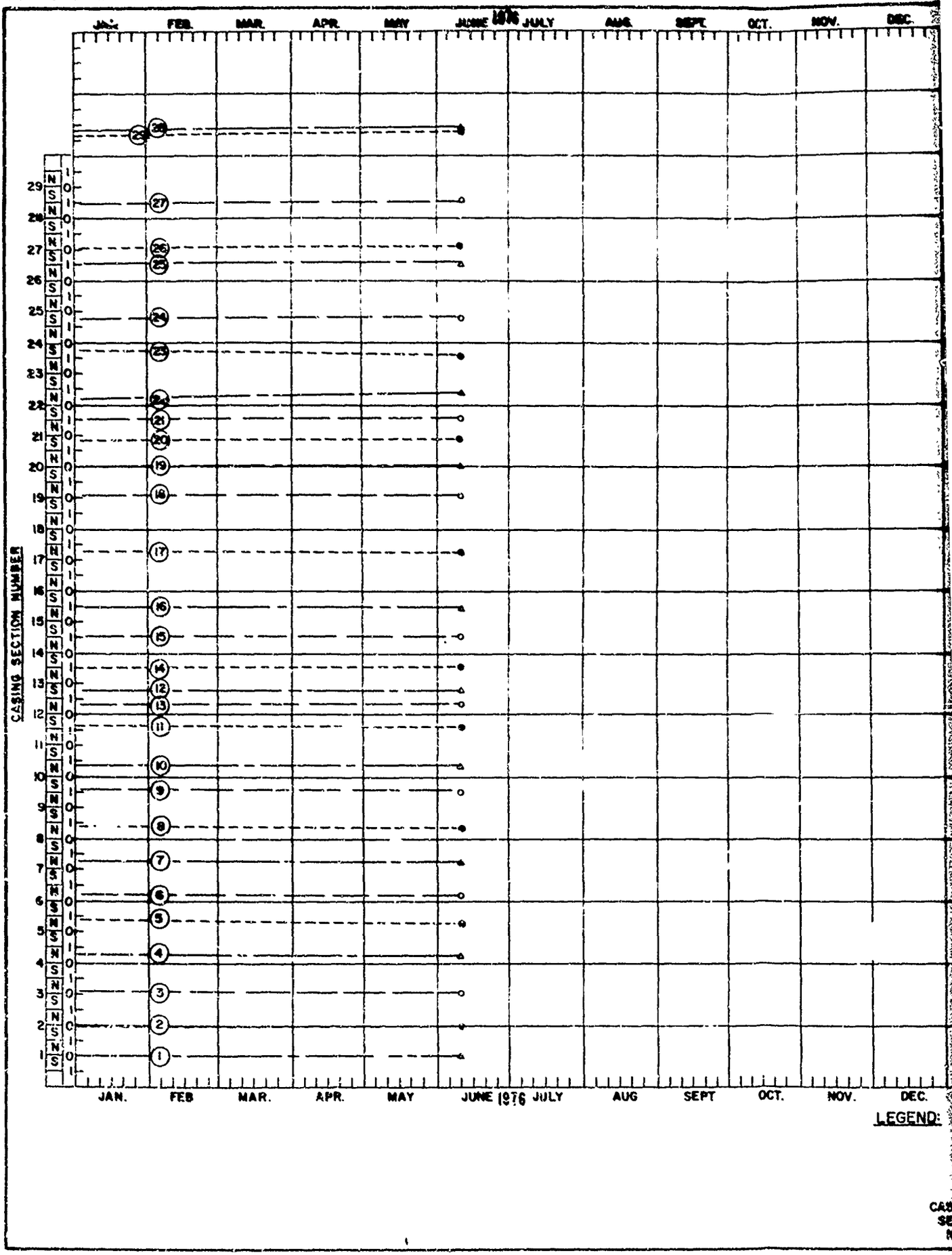
INCH VERTICAL DEFLECTION IN WESTERLY DIRECTION FROM INITIAL POSITION

ING
CTION
UMBER

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA E & W
VIF-92-2

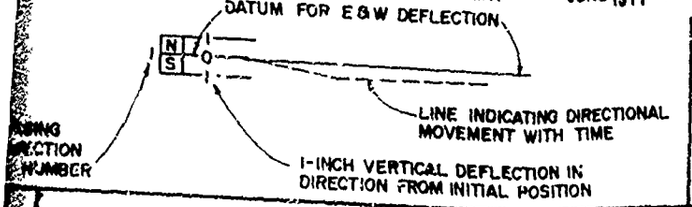
PLATE 20

CORPS OF ENGINEERS



U.S. ARMY

JAN. FEB. MAR. APR. MAY JUNE 1977 JULY AUG. SEPT. OCT. NOV. DEC.



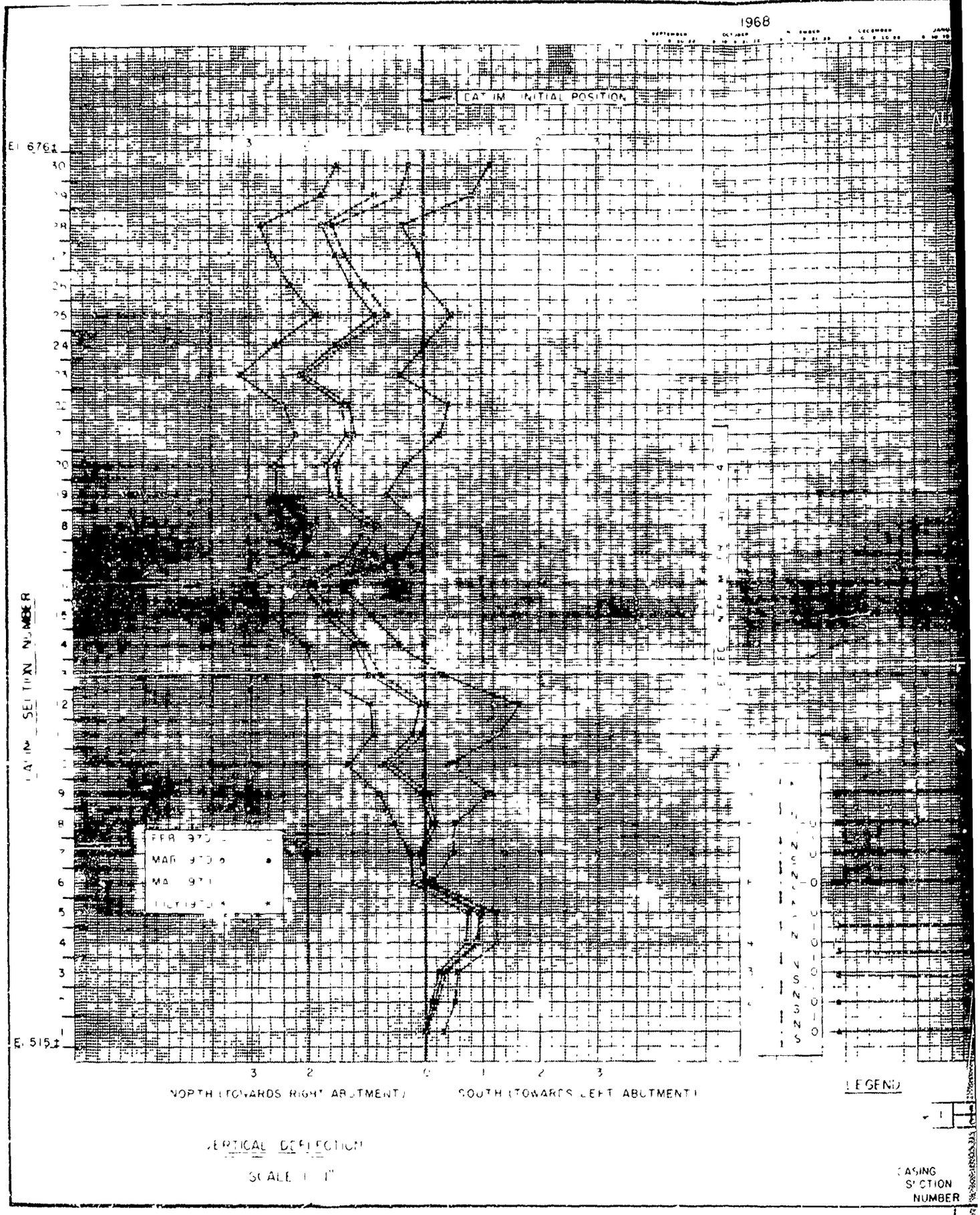
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.

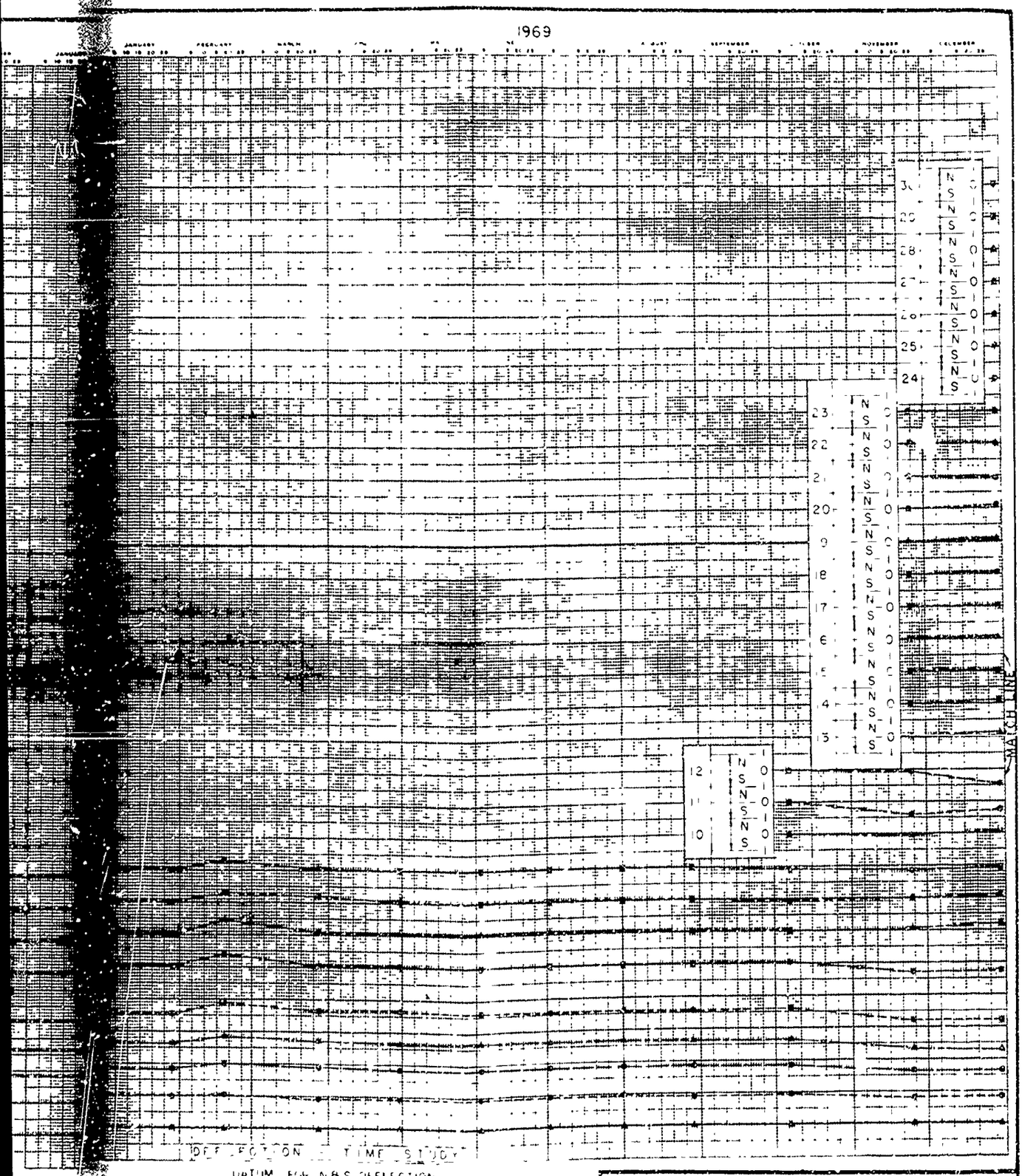
BELTZVILLE LAKE

VERTICAL DEFLECTION DATA E&W

VIF 92-2

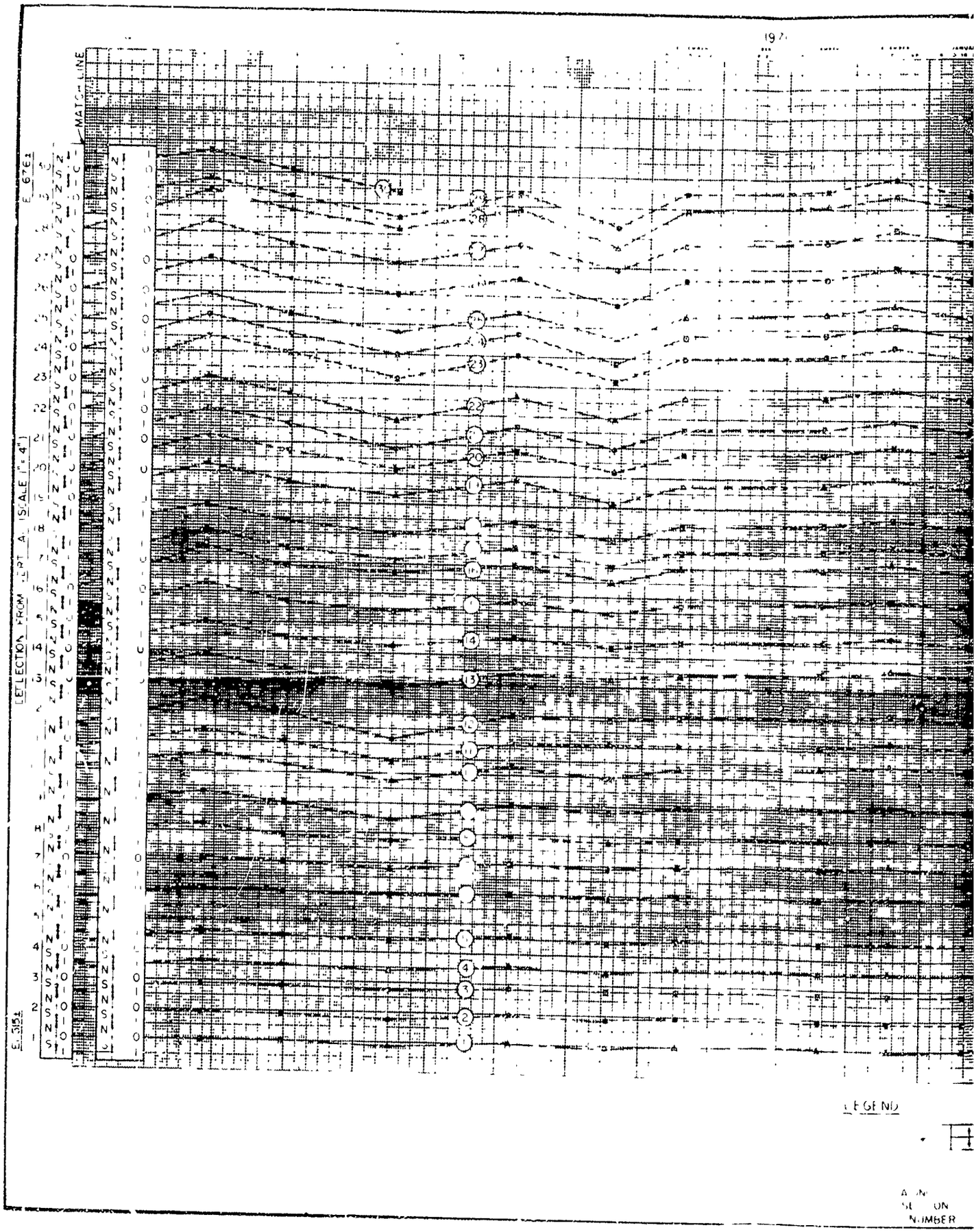
PLATE 21

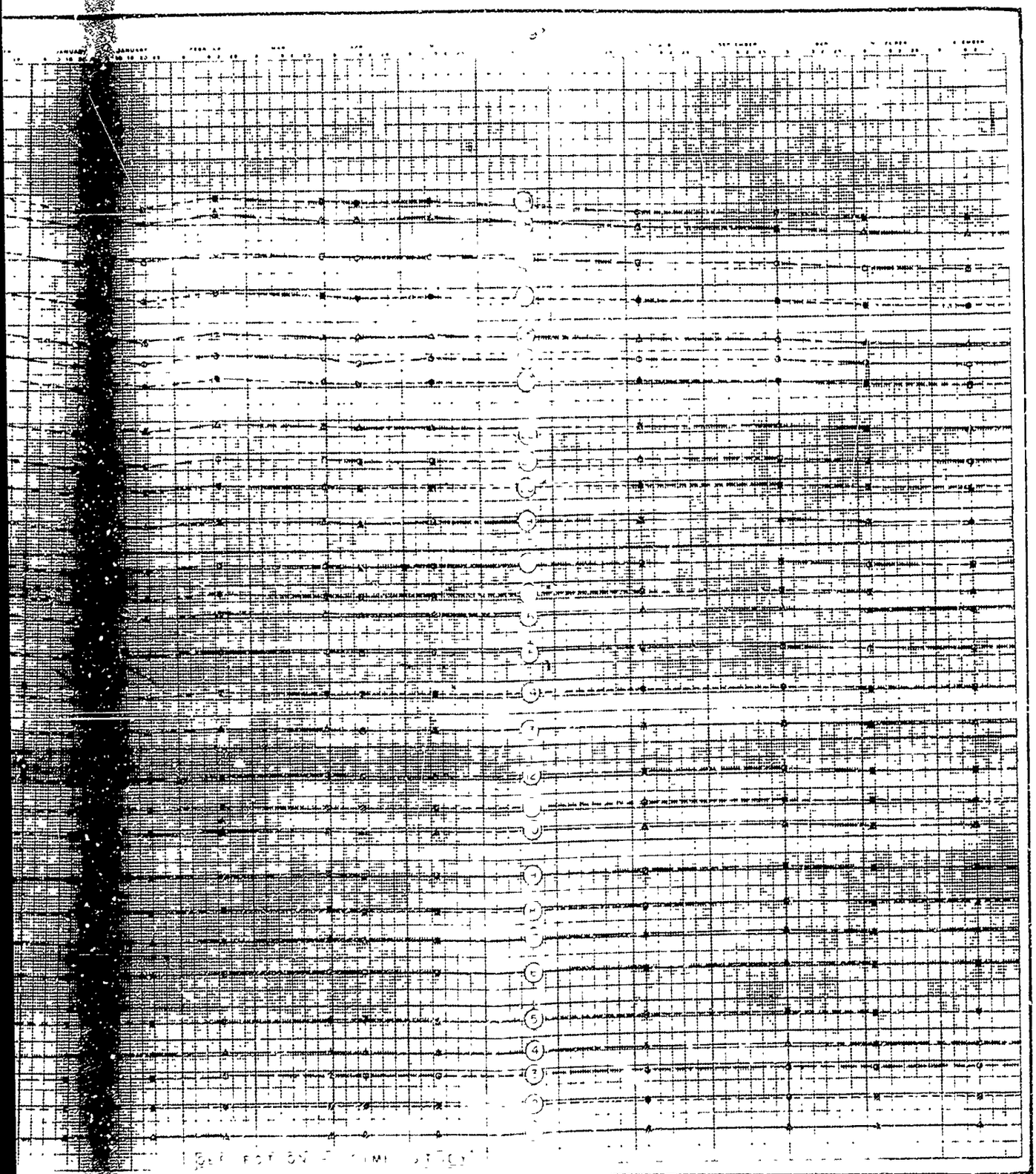

1968
CAT IM INITIAL POSITION
EL 676
EL 515
DAM SECTION NUMBER
FEB 97
MAR 97
MA 97
NORTH (TOWARDS RIGHT ABUTMENT)
SOUTH (TOWARDS LEFT ABUTMENT)
LEGEND
VERTICAL DEFLECTION
SCALE 1" = 1"
CASING SECTION NUMBER



LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA-N&S
VIF-92-2

PLATE 22

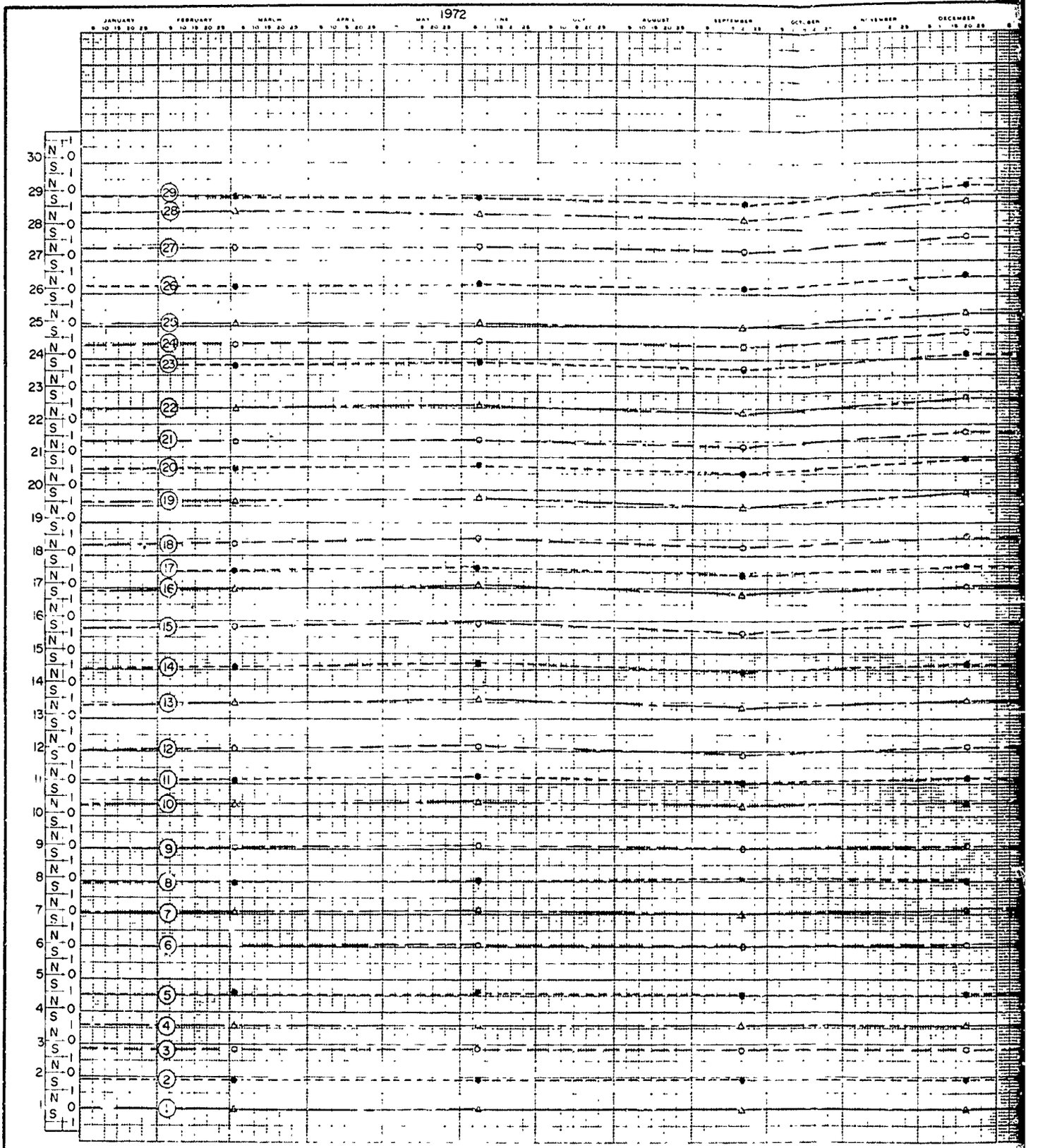

MATCH LINE
E 67E±
E 315±
LEGEND



LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA N & S
VIF-92-2

PLATE 23

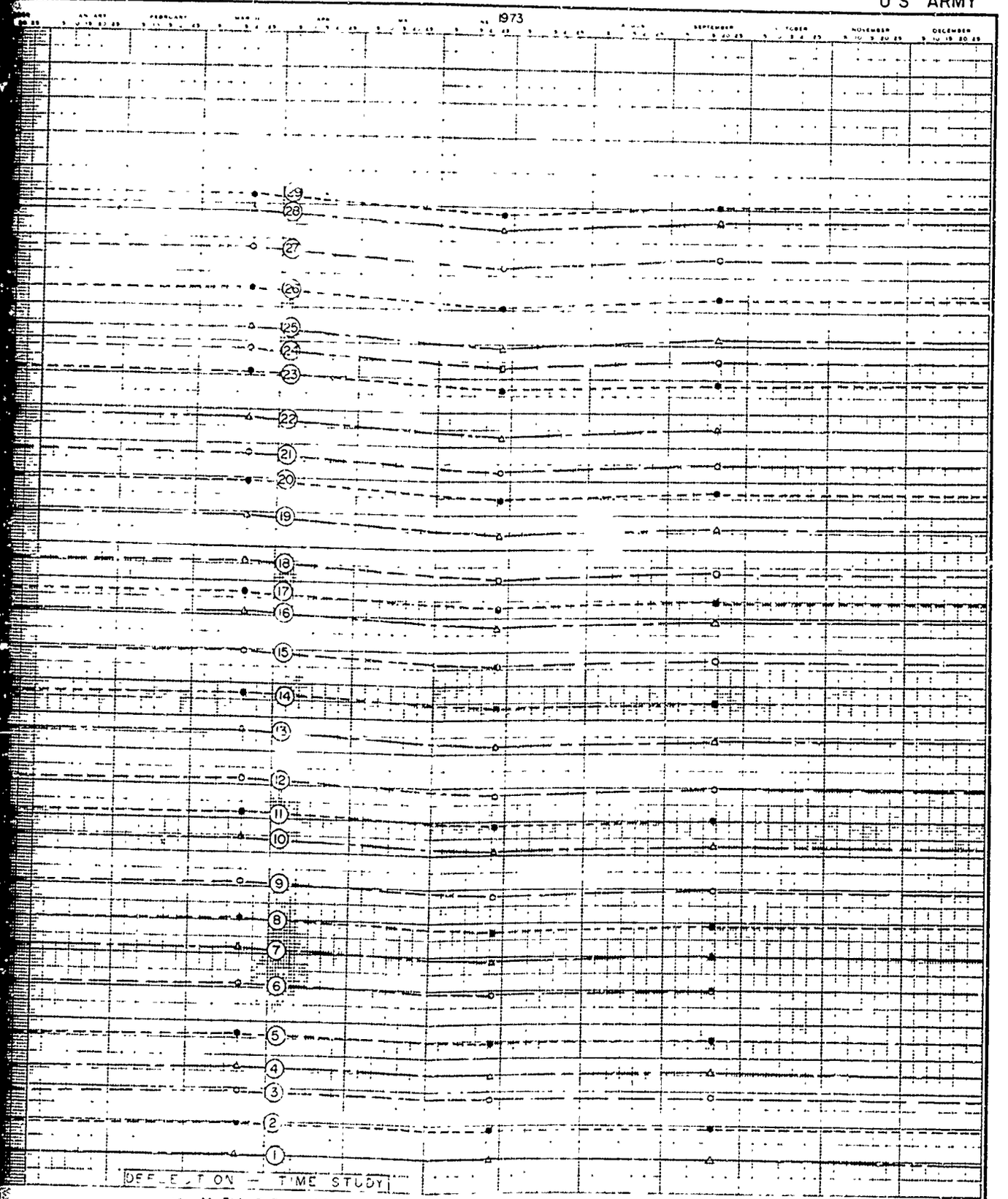
CORPS OF ENGINEERS



LEGEND

CASING
SECTI
NUM

U S ARMY



DEFLECTION - TIME STUDY

JA JM F M E & N DEFLECTION

LINE INDICATING DIRECTIONAL MOVEMENT WITH TIME

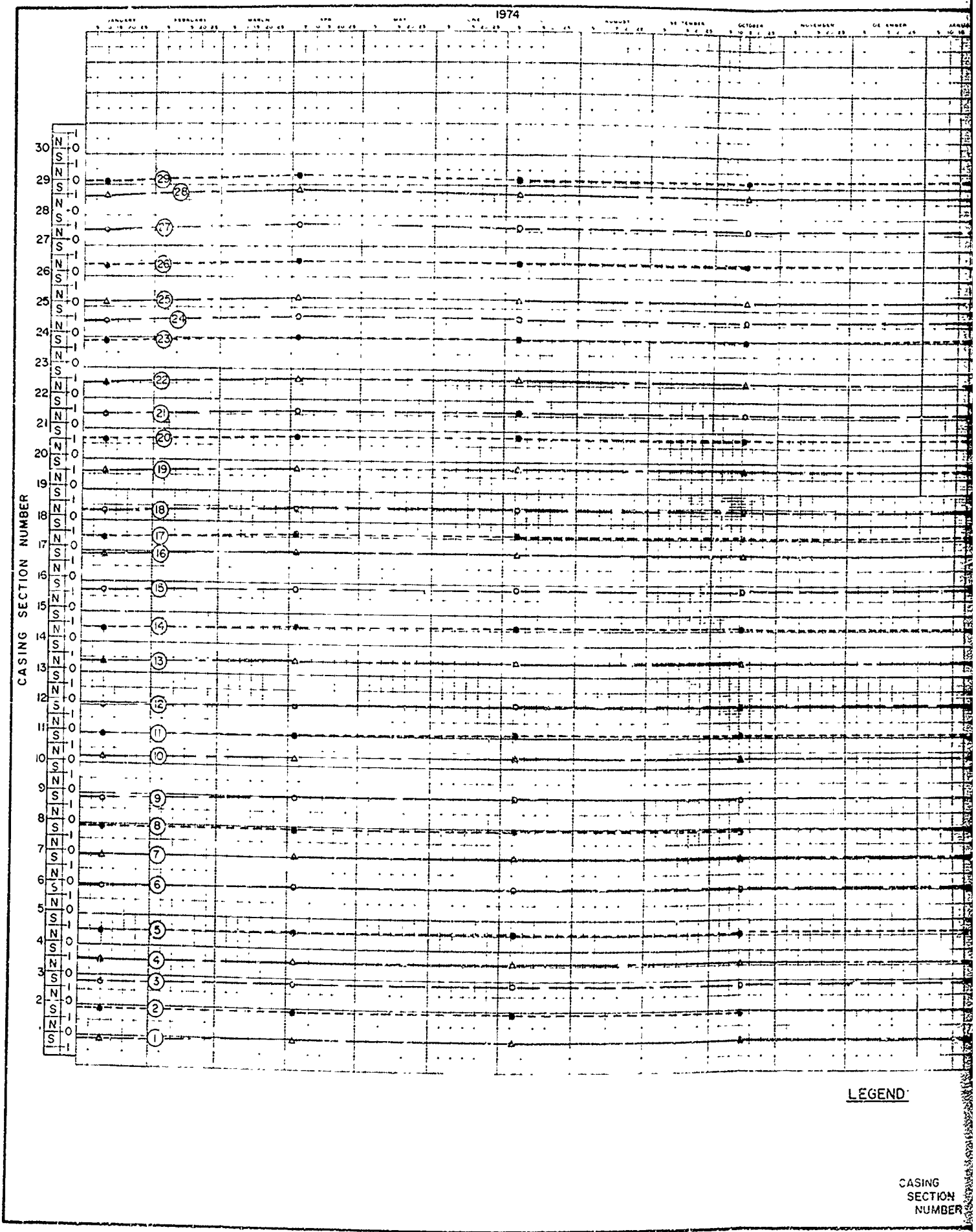
INCH VERTICAL DEFLECTION N & S OR E & W DIRECTION FROM INITIAL POSITION

CASING SECTION NUMBER

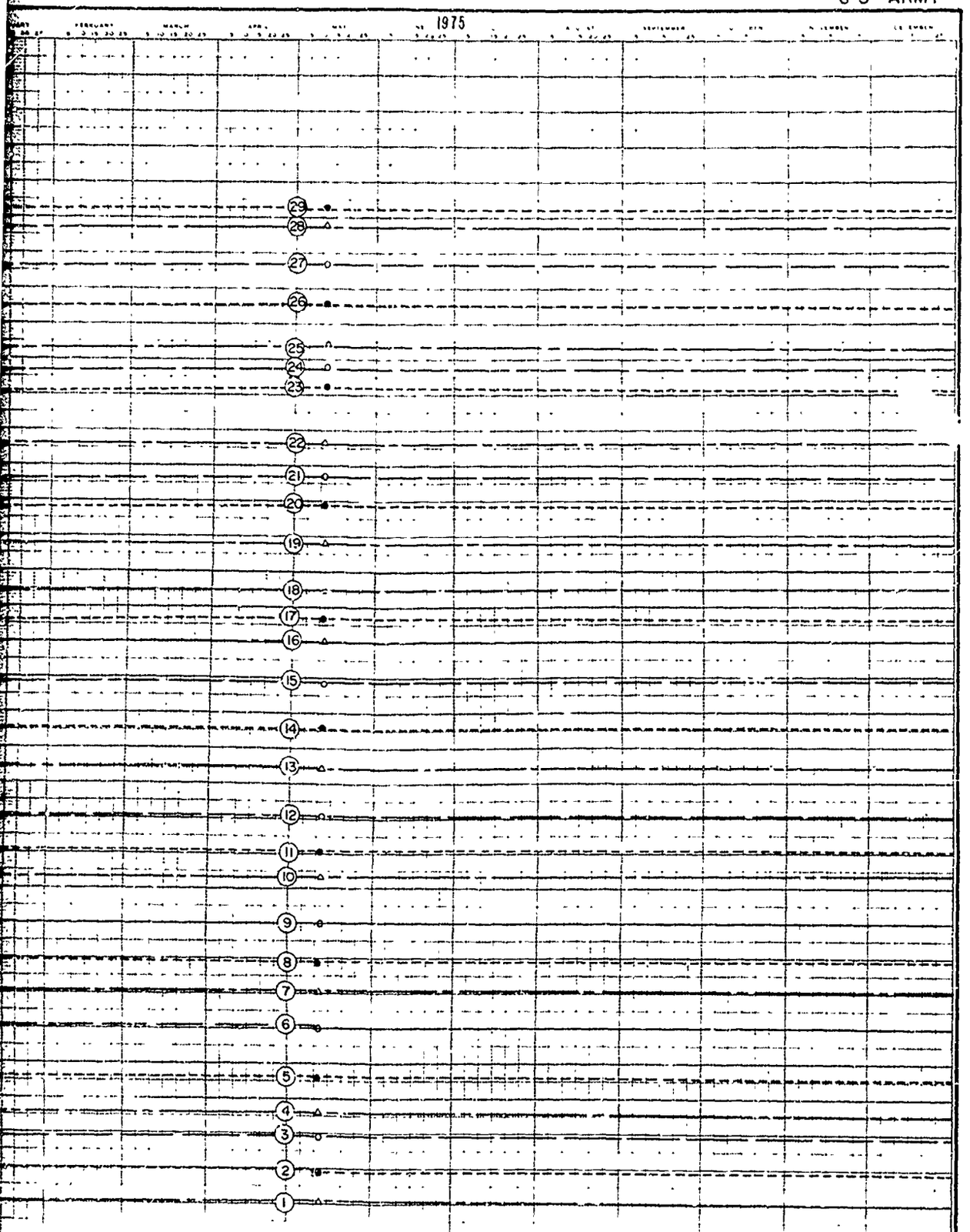
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA N & S
VIF-92-2

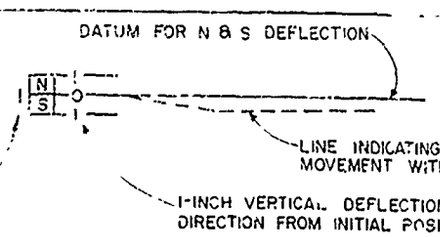
PLATE 24

CORPS OF ENGINEERS



U S ARMY

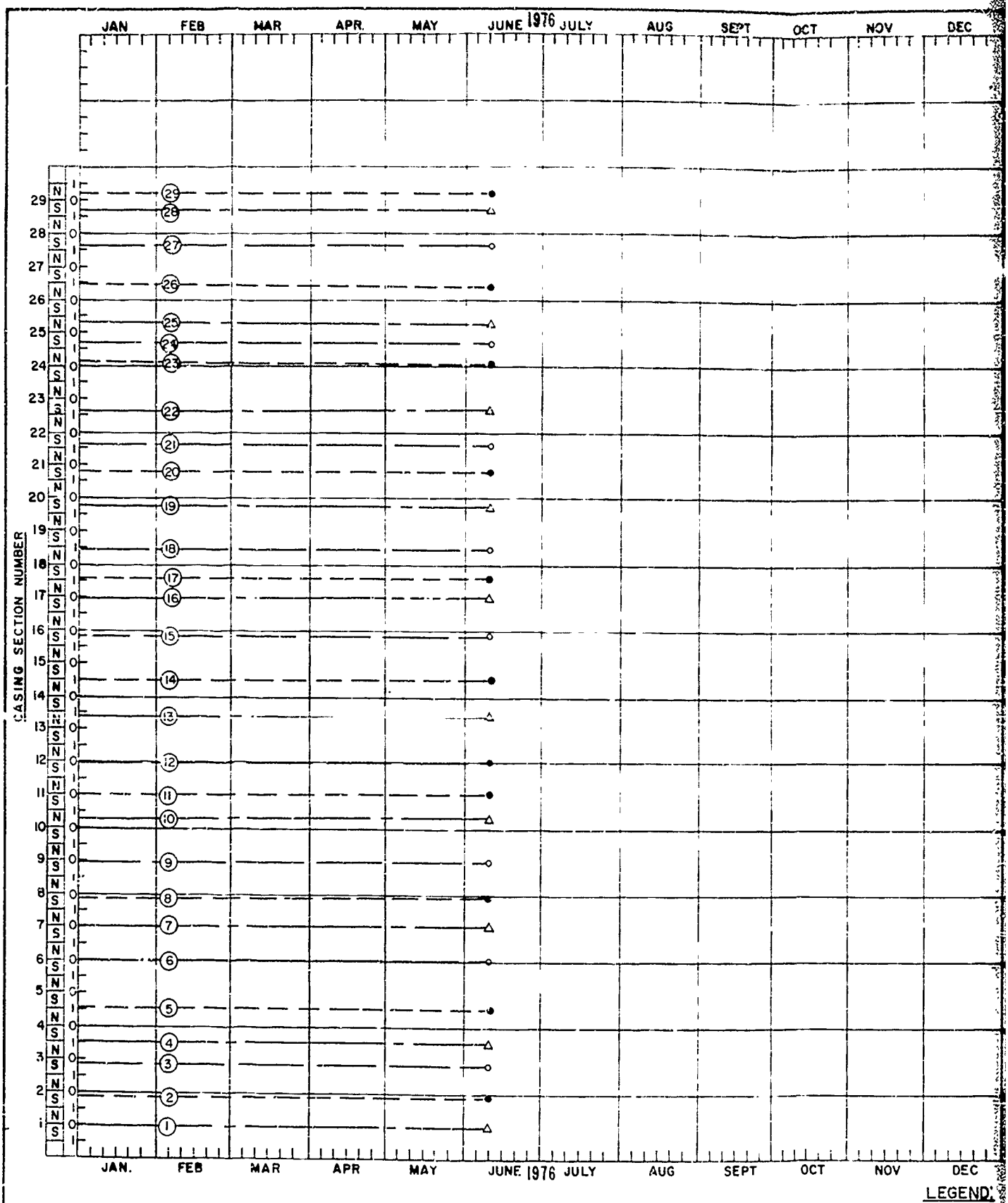




LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA N & S
VIF 92-2

PLATE 25

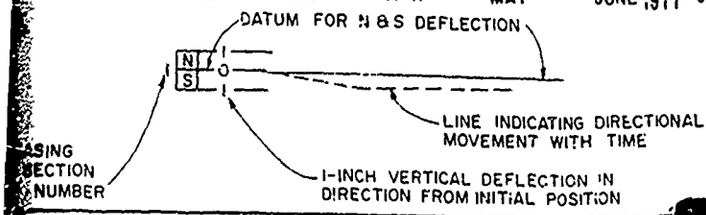
CORPS OF ENGINEERS



U.S. ARMY

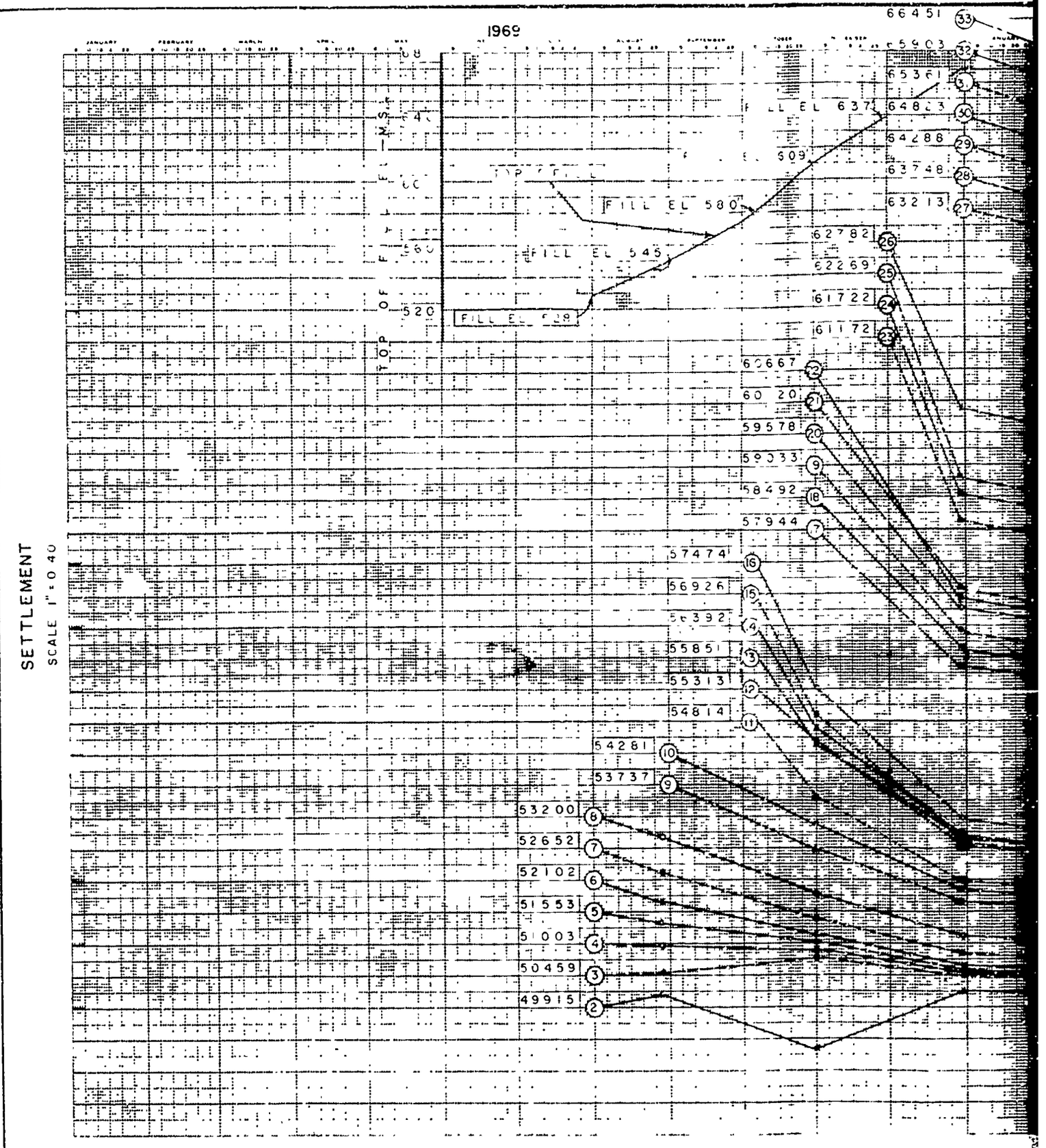
JAN. FEB. MAR APR MAY JUNE 1977 JULY AUG SEPT. OCT. NOV. DEC.

JAN FEB MAR APR MAY JUNE 1977 JULY AUG SEPT OCT NOV. DEC.

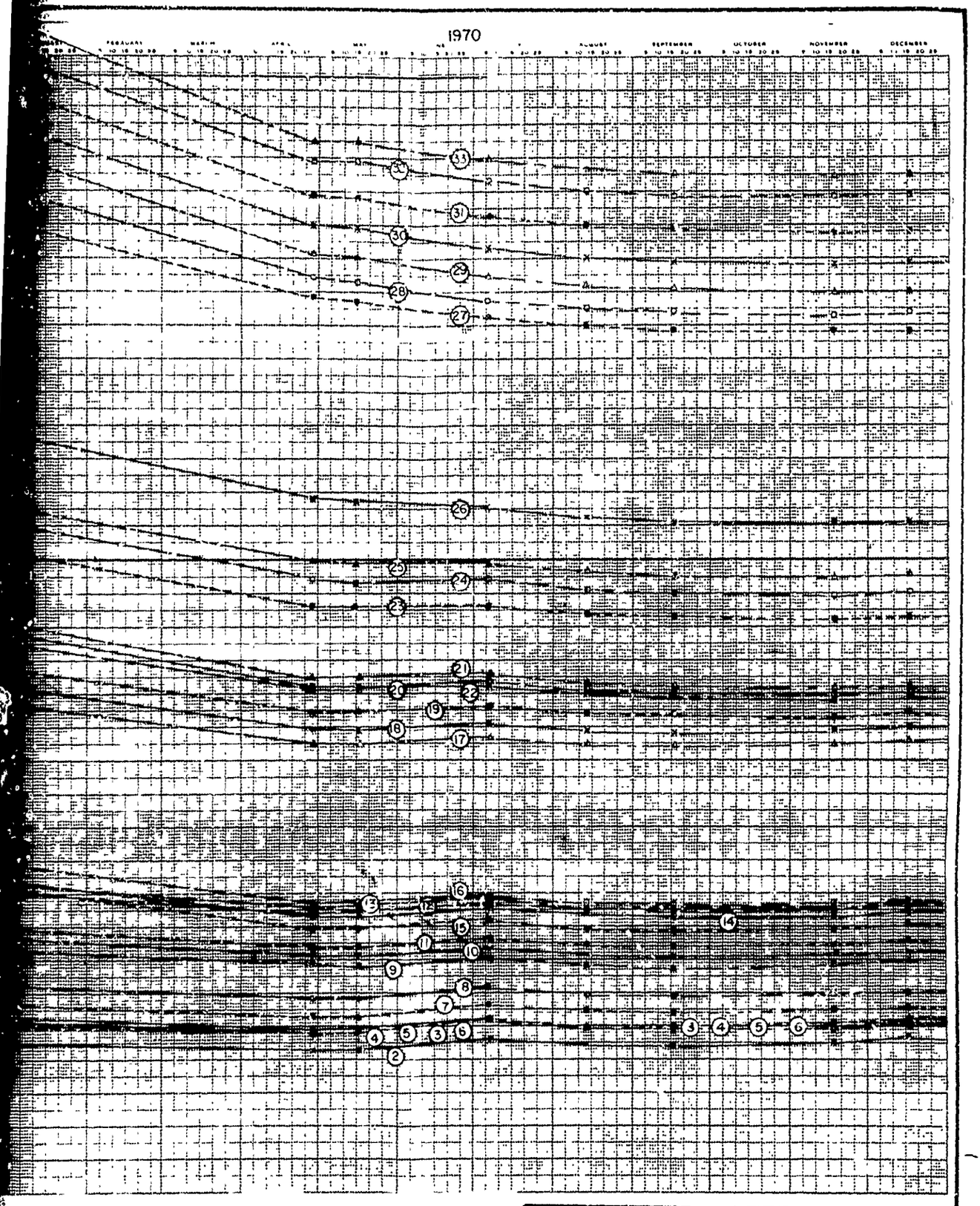


LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA N&S
VIF - 92-2

PLATE 26


1969
SETTLEMENT
SCALE 1" = 0 40
FILL EL 637
FILL EL 609
FILL EL 580
FILL EL 545
FILL EL 528
66451
65361
64823
64288
63748
63213
62782
62269
61722
61172
60667
60020
59578
59033
58492
57944
57474
56926
56392
55851
55313
54814
54281
53737
53200
52652
52102
51553
51003
50459
49915

NOTE

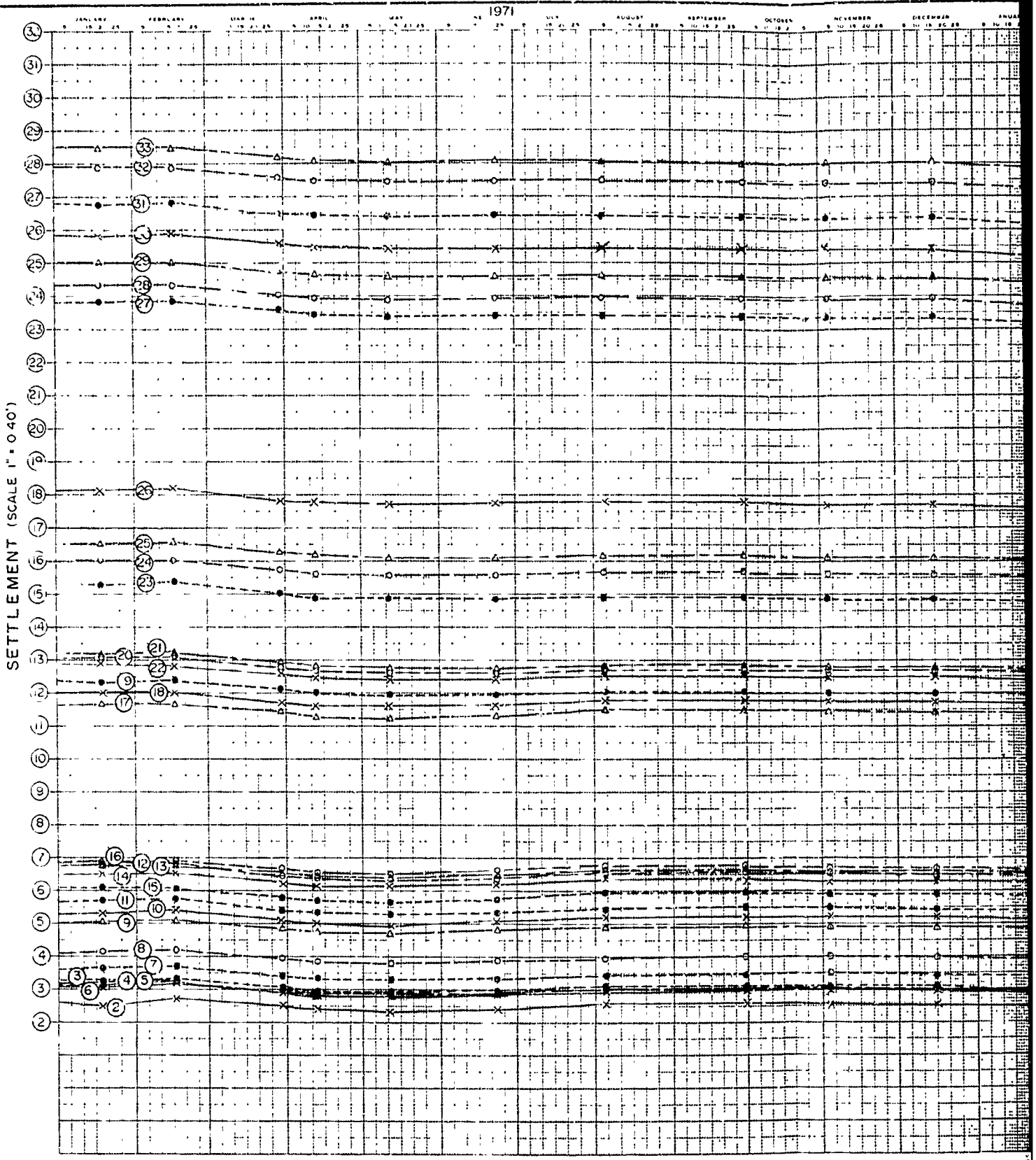


NOTE 49915 ⓒ INITIALLY INSTALLED BOTTOM ELEVATION FOR CASING # 2

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF-95-2 1969-1970

PLATE 27-2

CORPS OF ENGINEERS



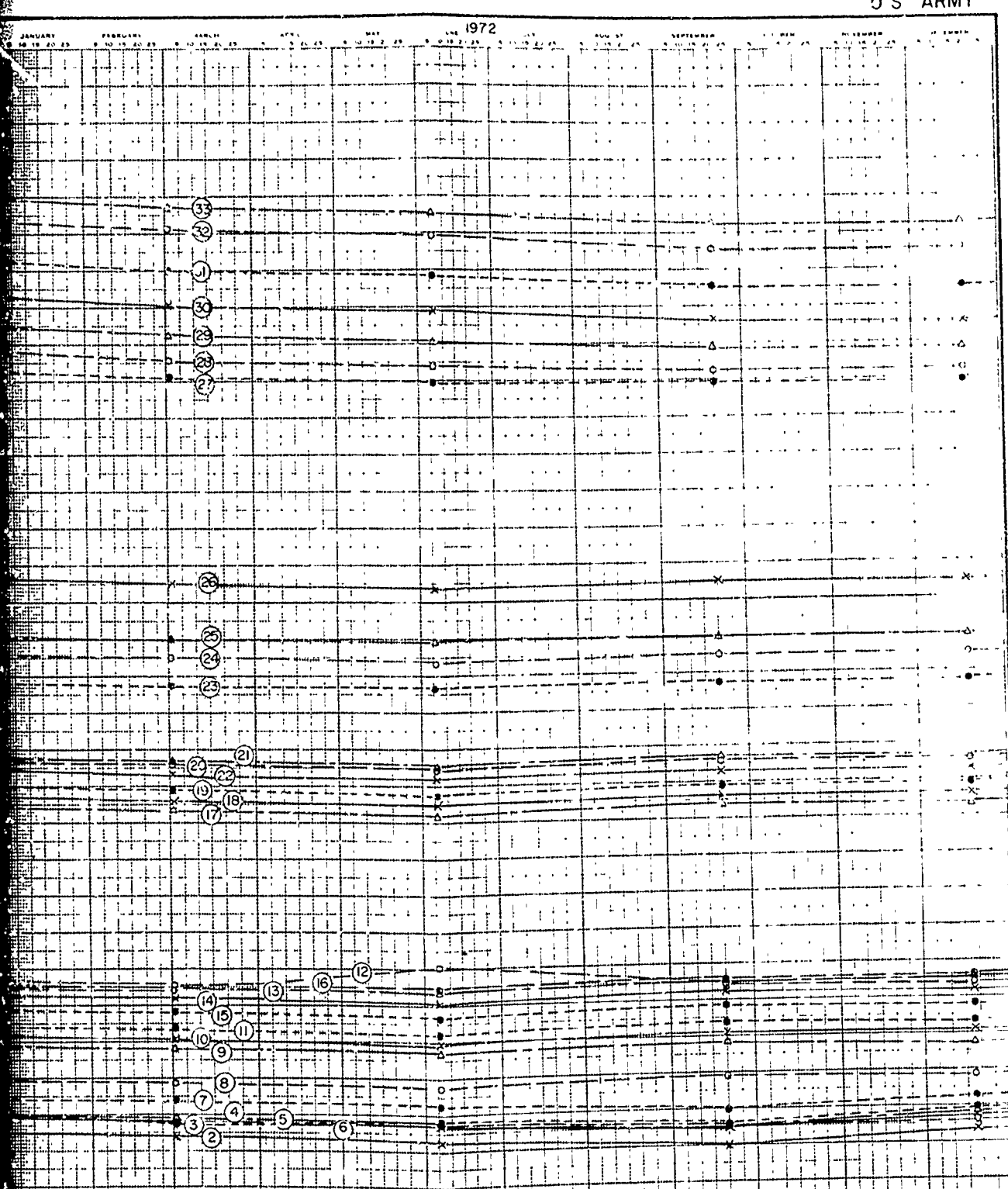
NOTE

Initial datum for settlement of section casing (2)

(2)

Measured settlement in section casing (2)

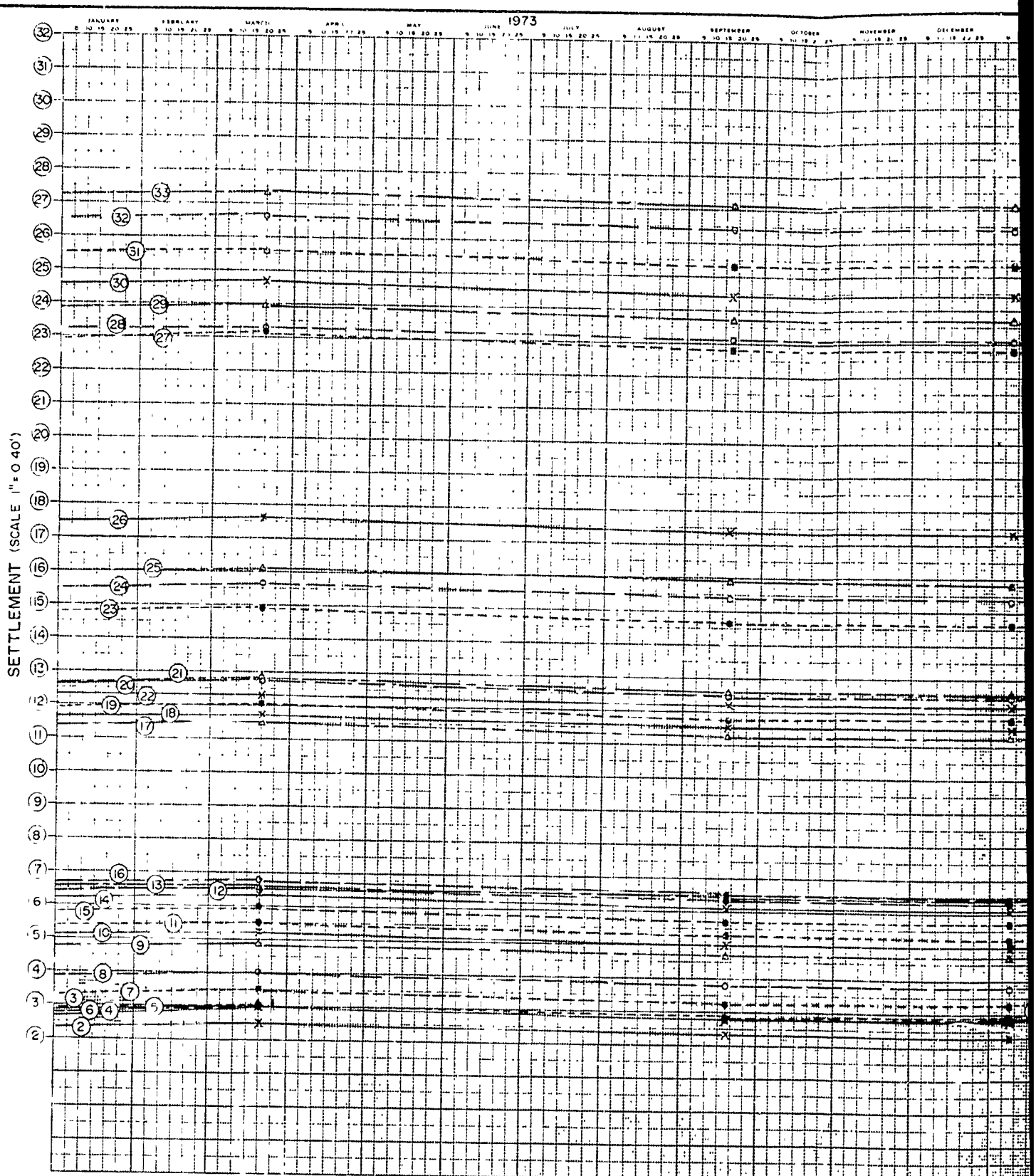
U S ARMY



LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF-95-2 1971-1972

PLATE 28

CORPS OF ENGINEERS



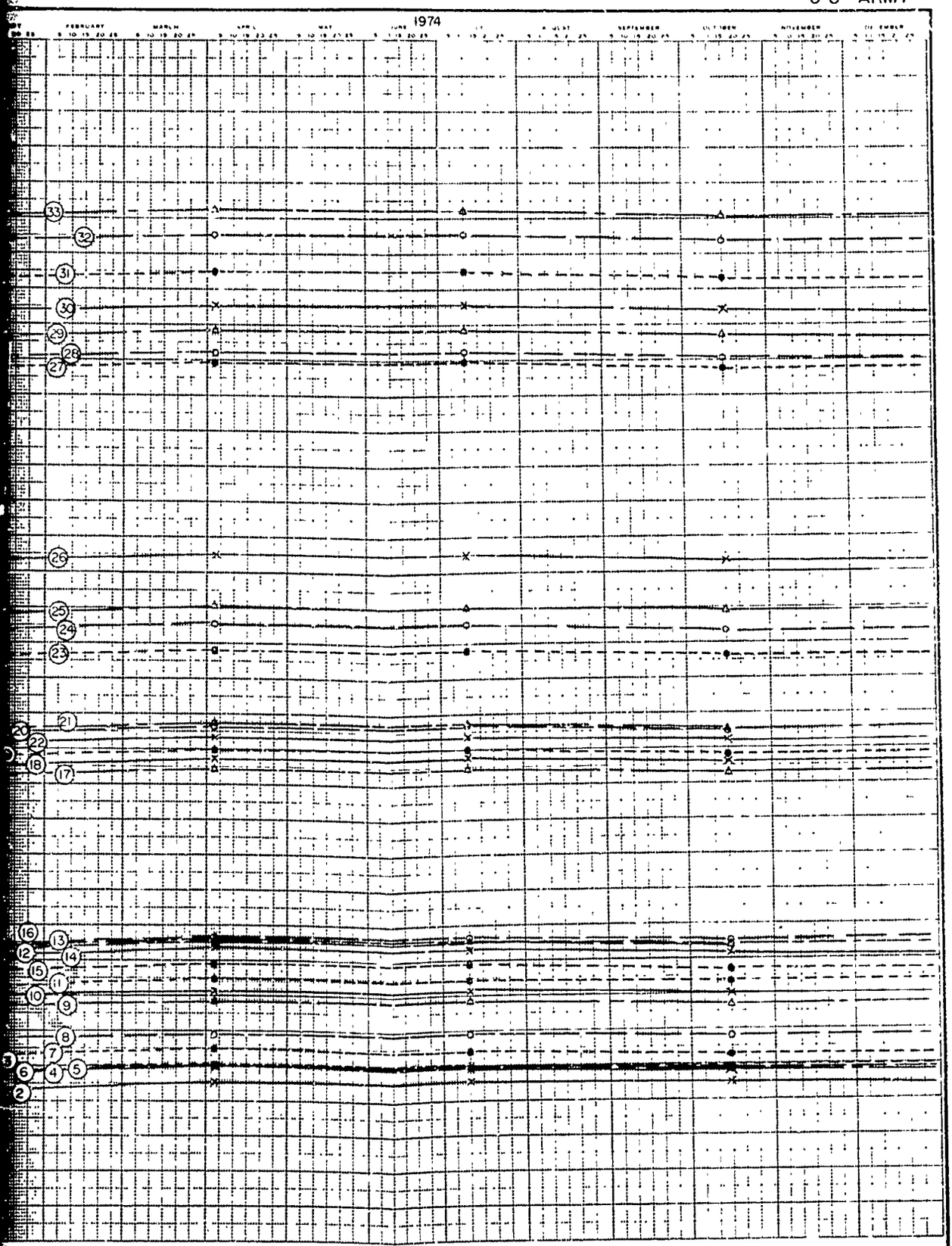
NOTE

Initial datum for settlement of section casing (2)

(2)

Measured settlement in section casing (2)

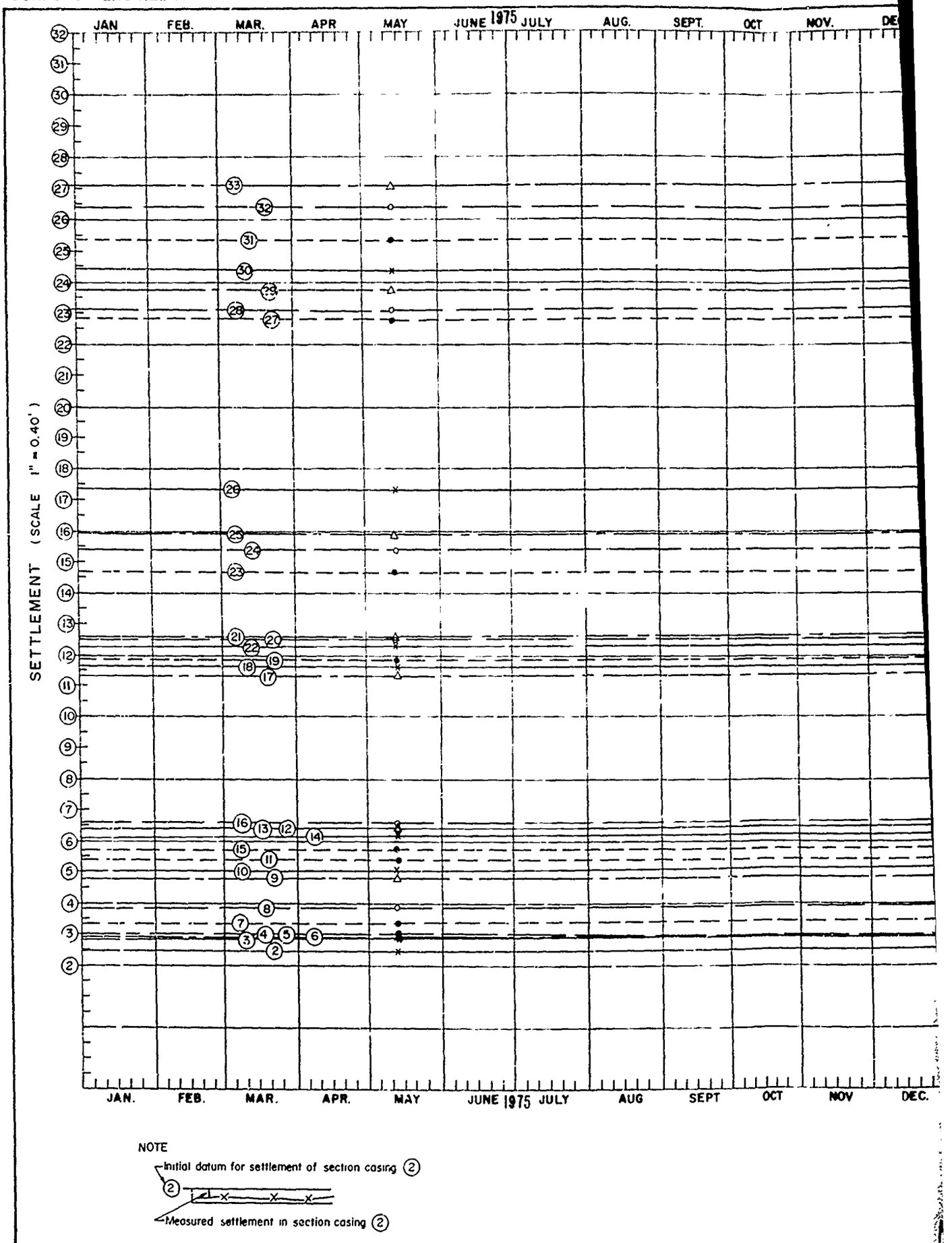
U S ARMY



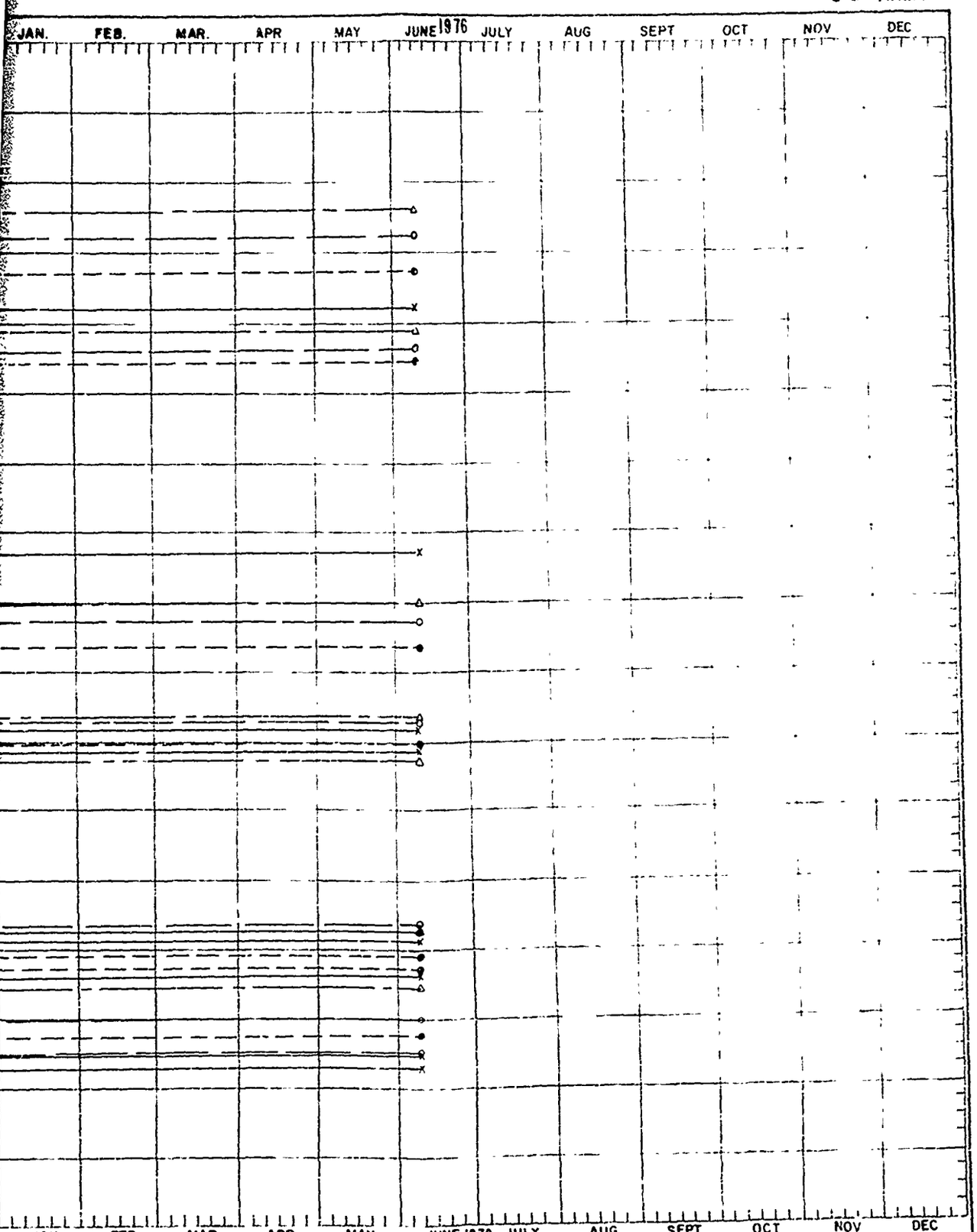
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF - 95 - 2 1973 - 1974

PLATE 29

CORPS OF ENGINEERS

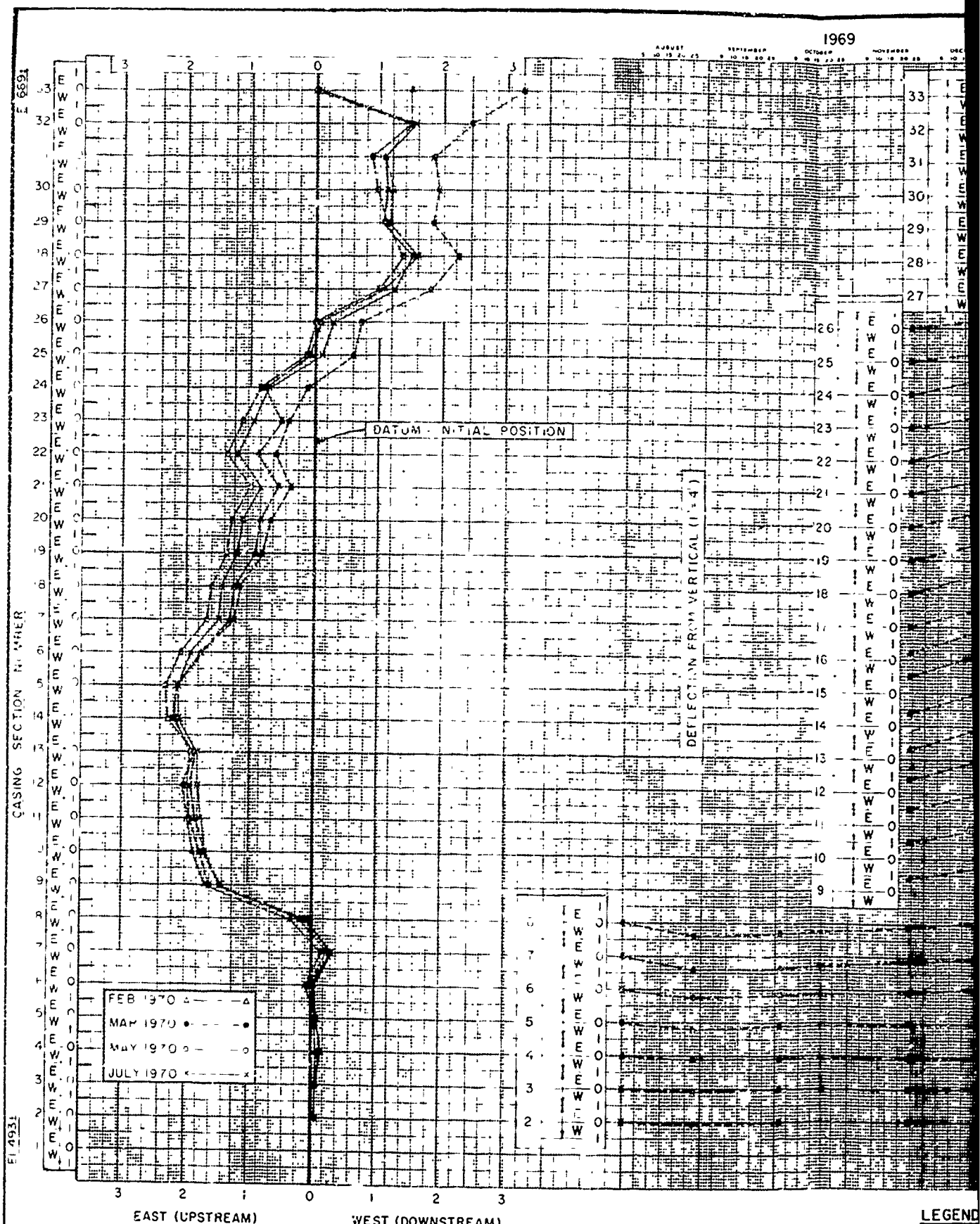


U S ARMY



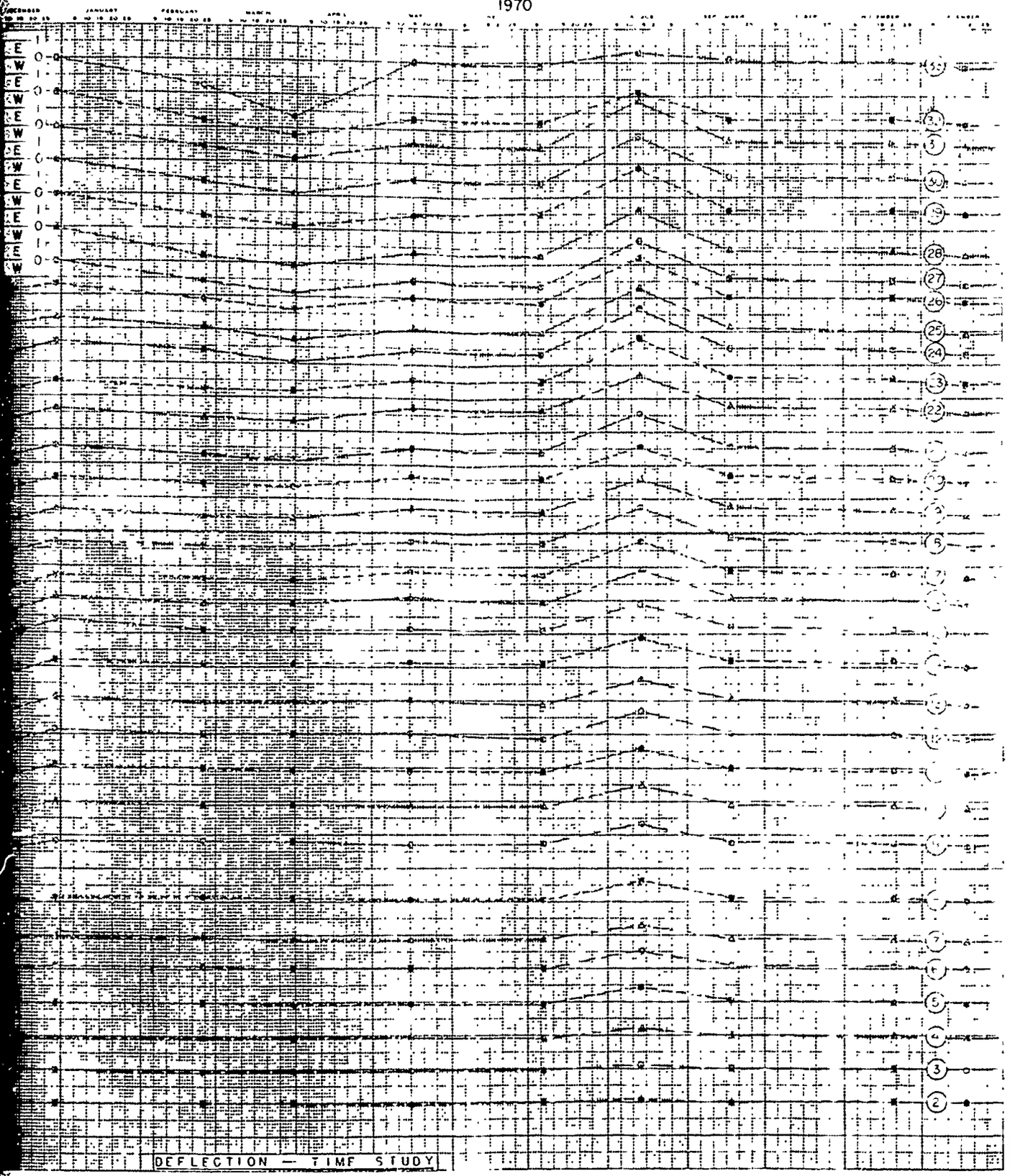
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF 95-2 1975-1976

PLATE 30

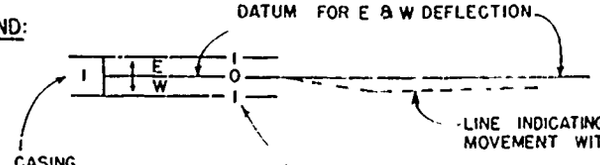


VERTICAL DEFLECTION

SCALE 1" = 1'

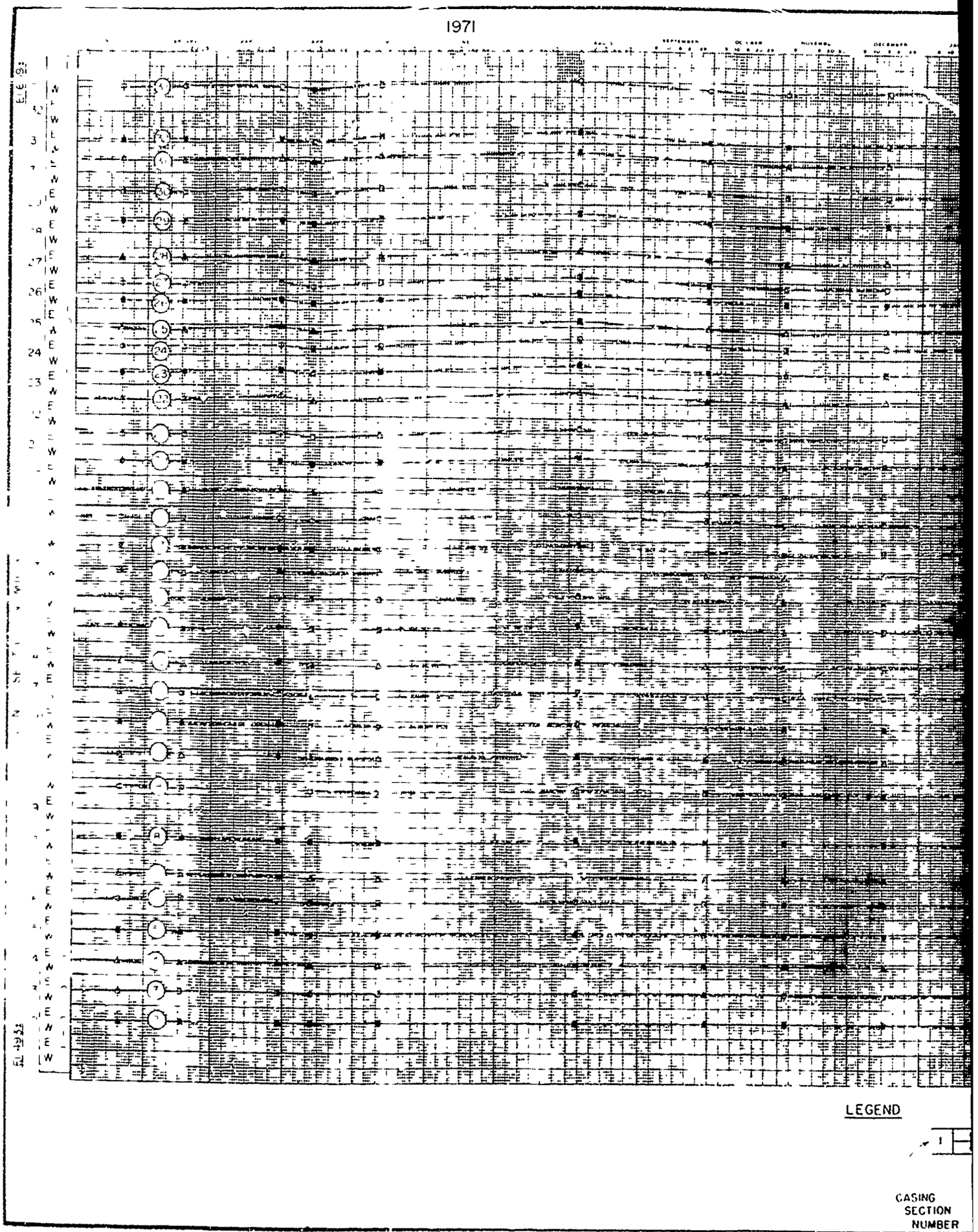


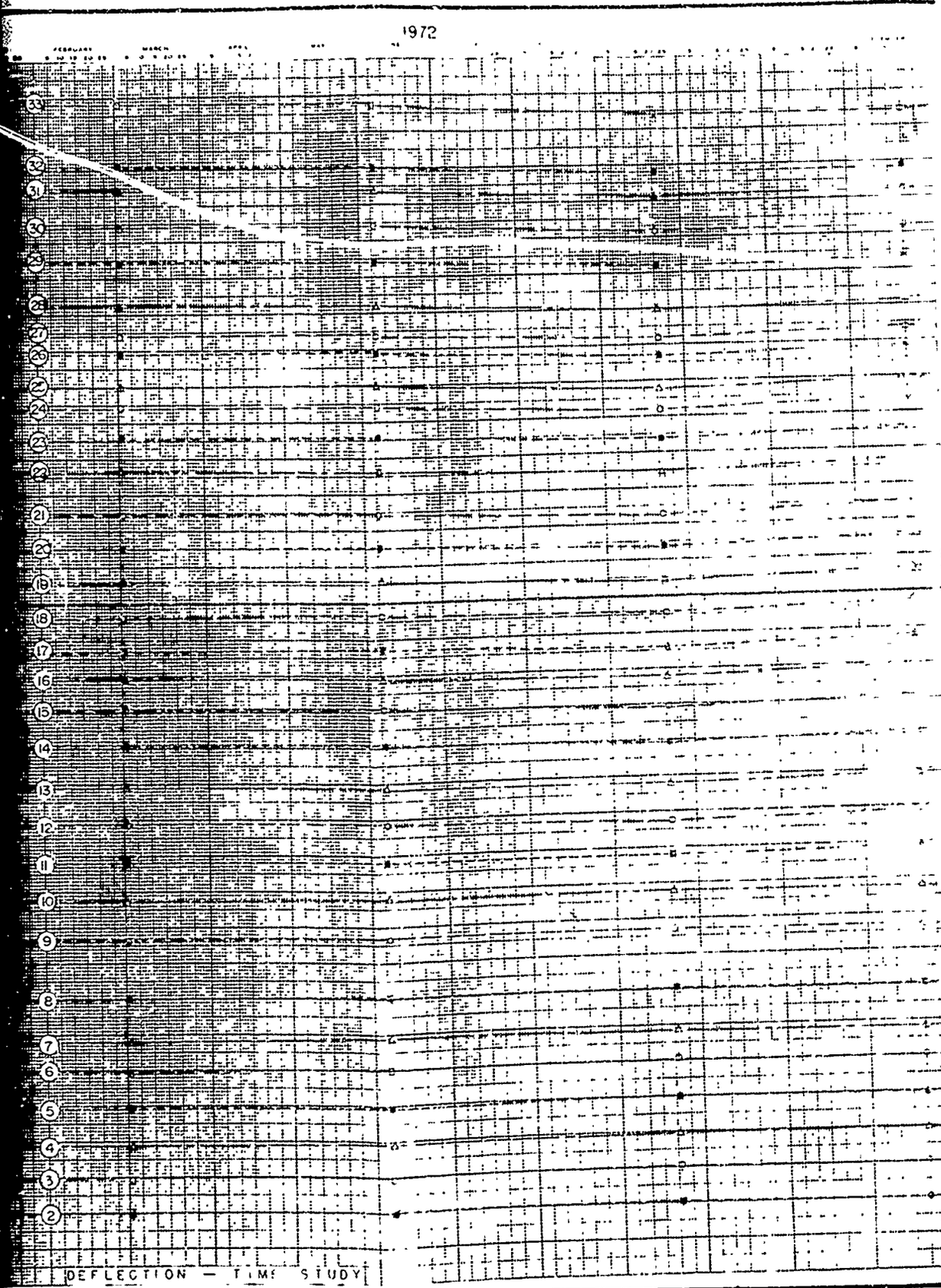
LEGEND:



LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA - E & W
VIF-95-2

PLATE 31

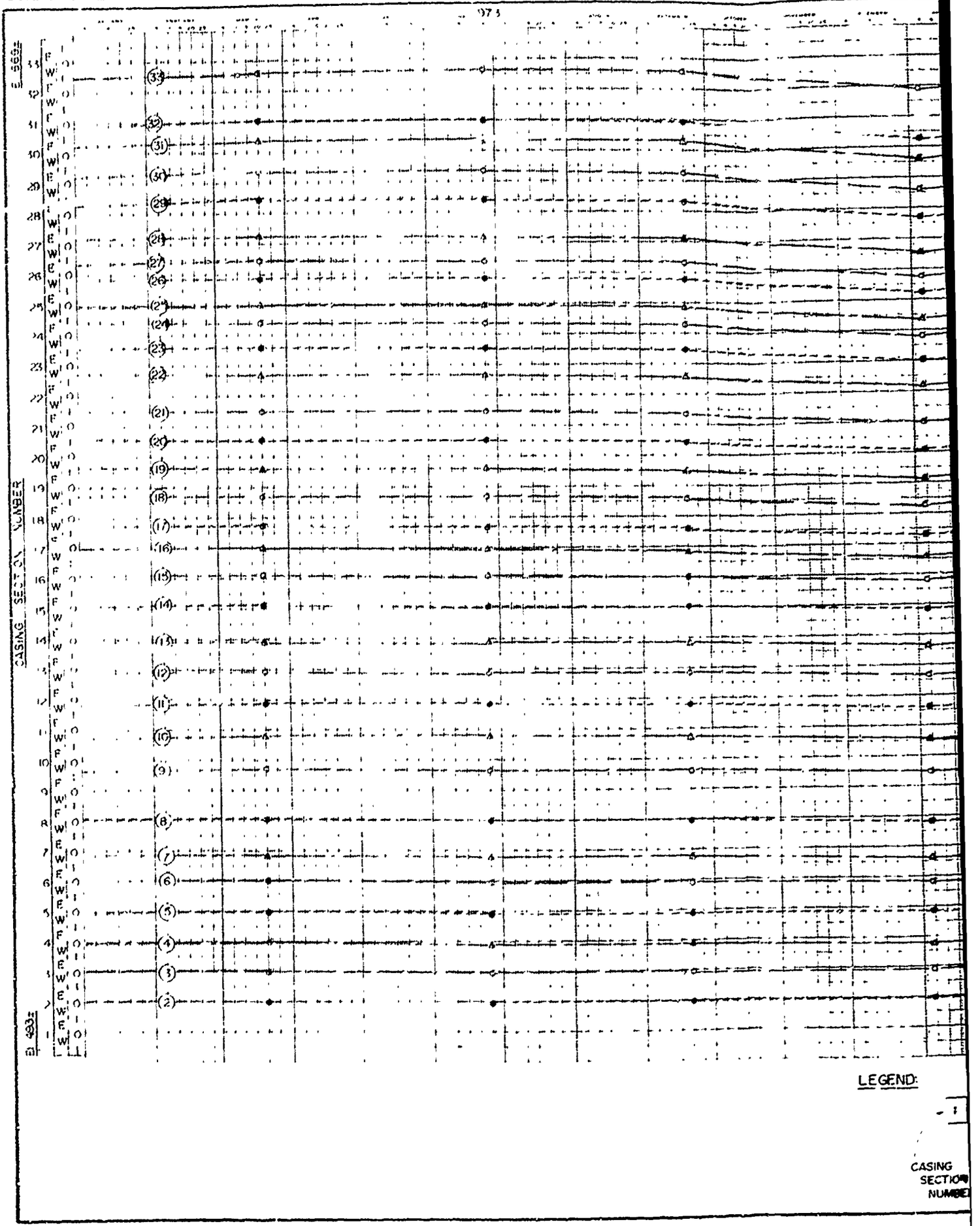

1971
LEGEND
CASING SECTION NUMBER



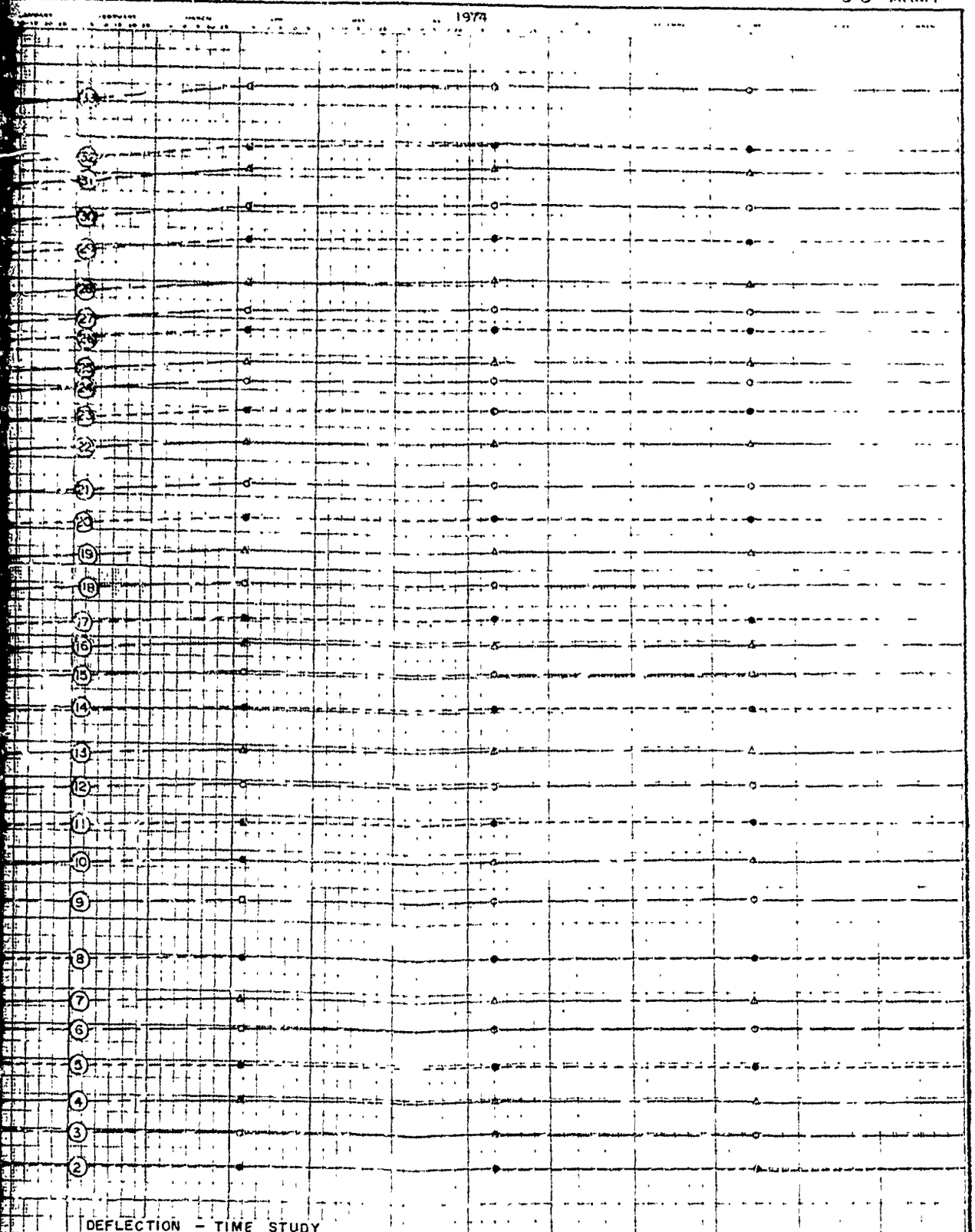
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA E & W
VIF-95-2

PLATE 32

CORPS OF ENGINEERS

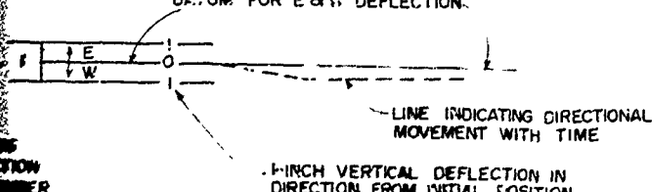


U S ARMY



DEFLECTION – TIME STUDY

DATUM FOR E & W DEFLECTION

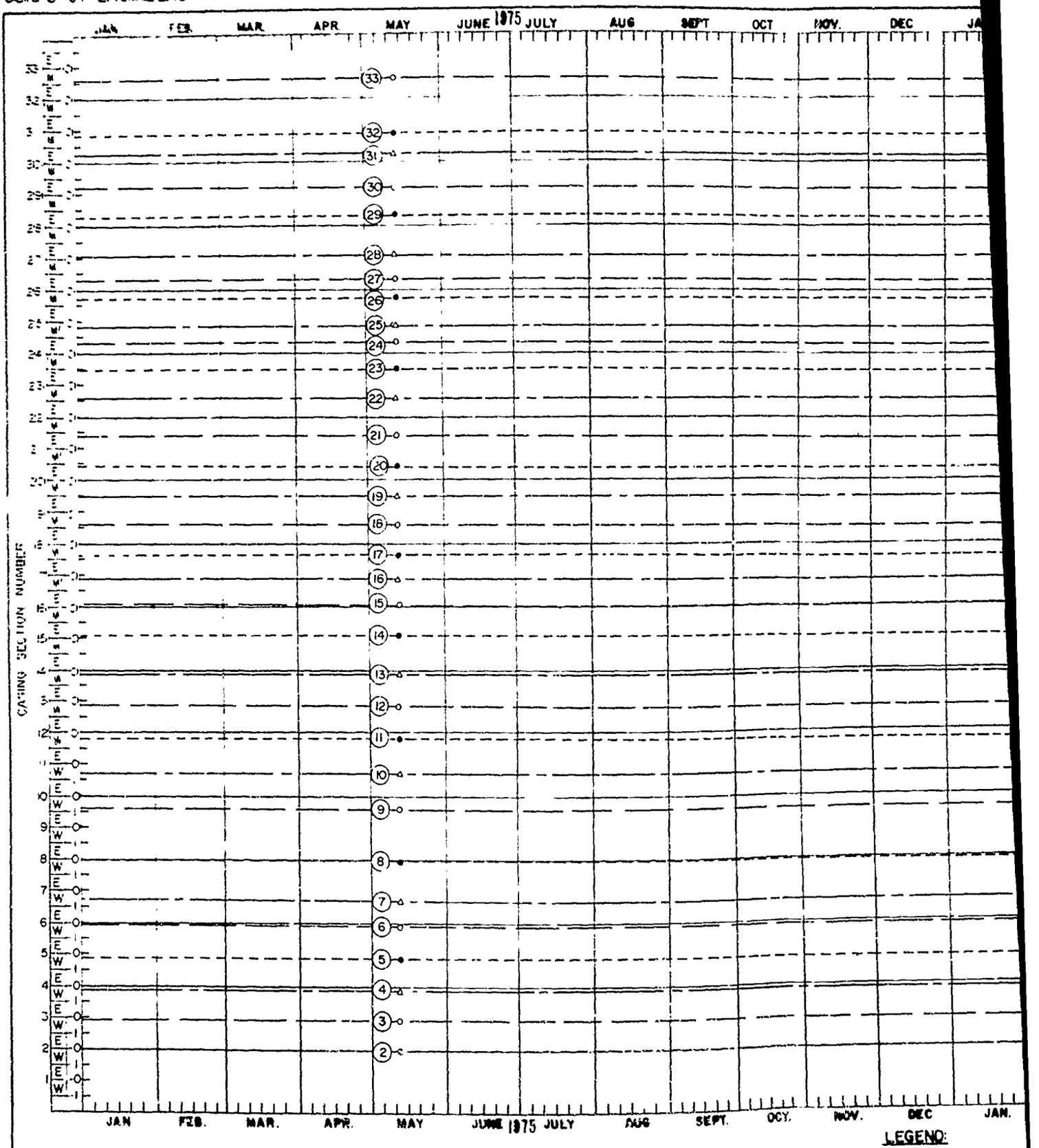


LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.

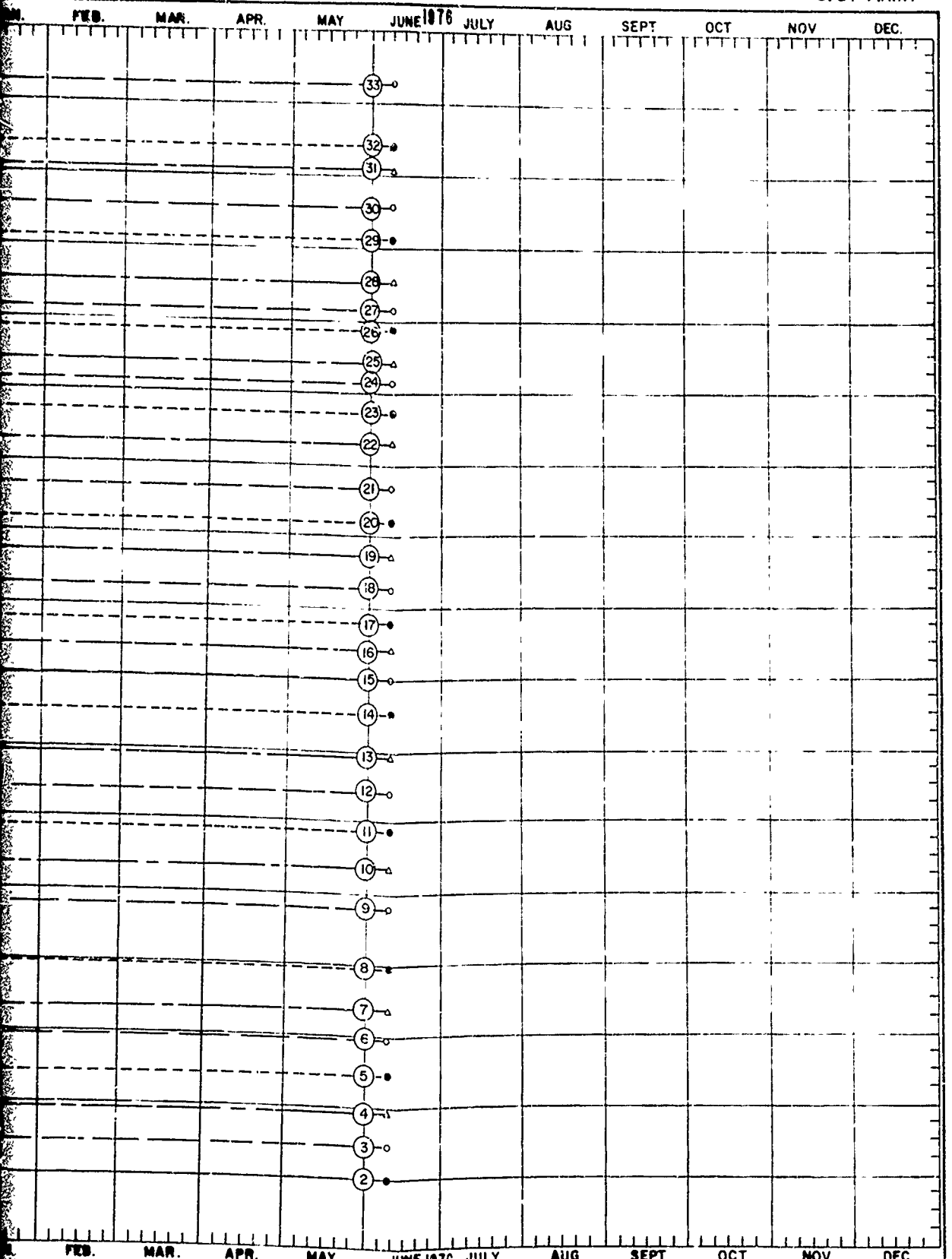
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA E & W
VIF - 95-2

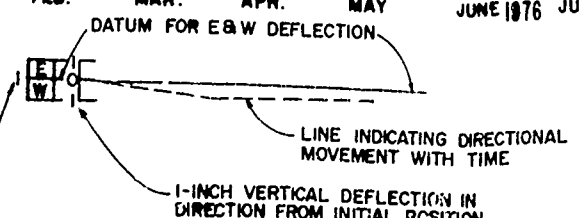
PLATE 33

CORPS OF ENGINEERS



U.S. ARMY

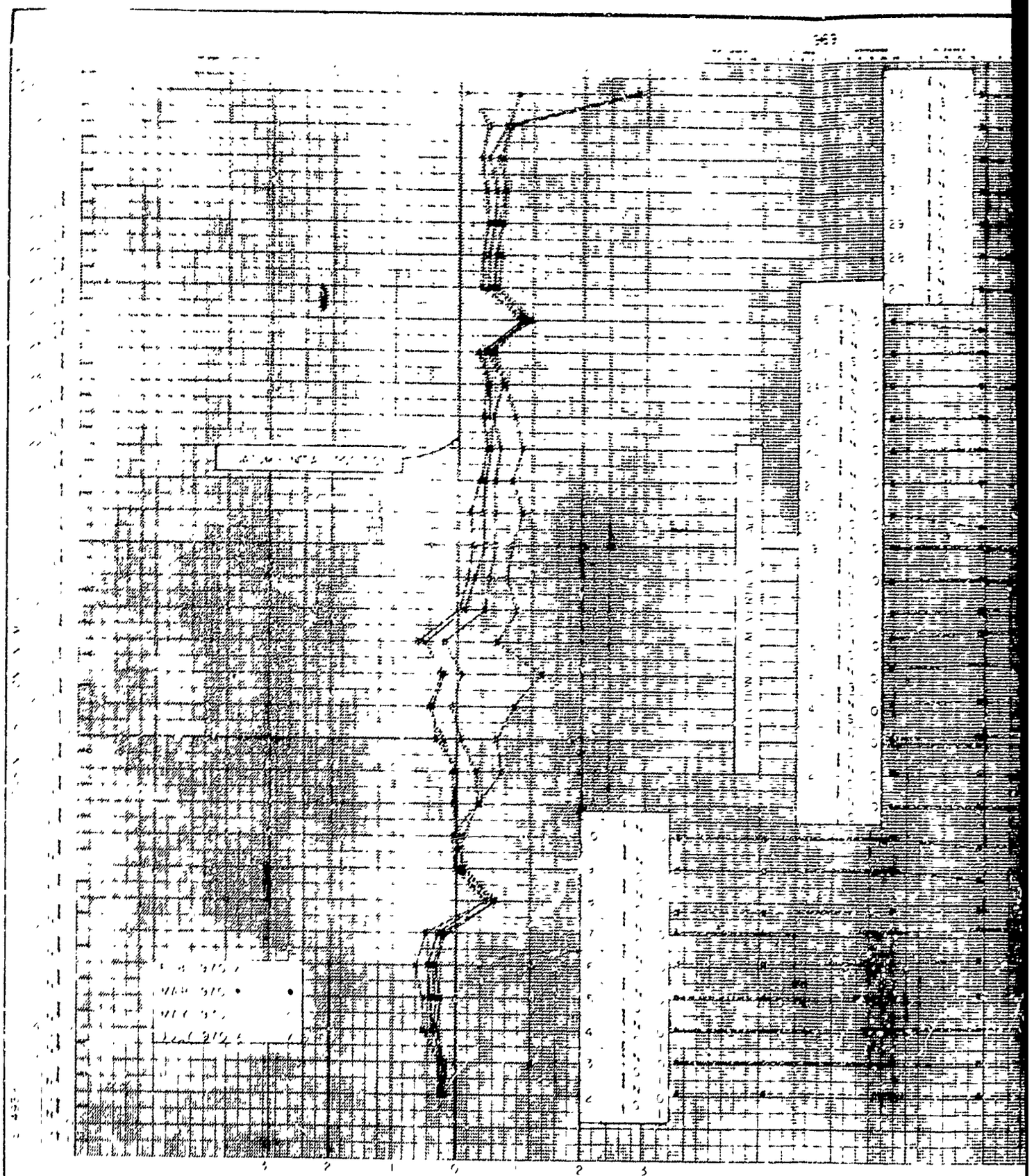




LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.

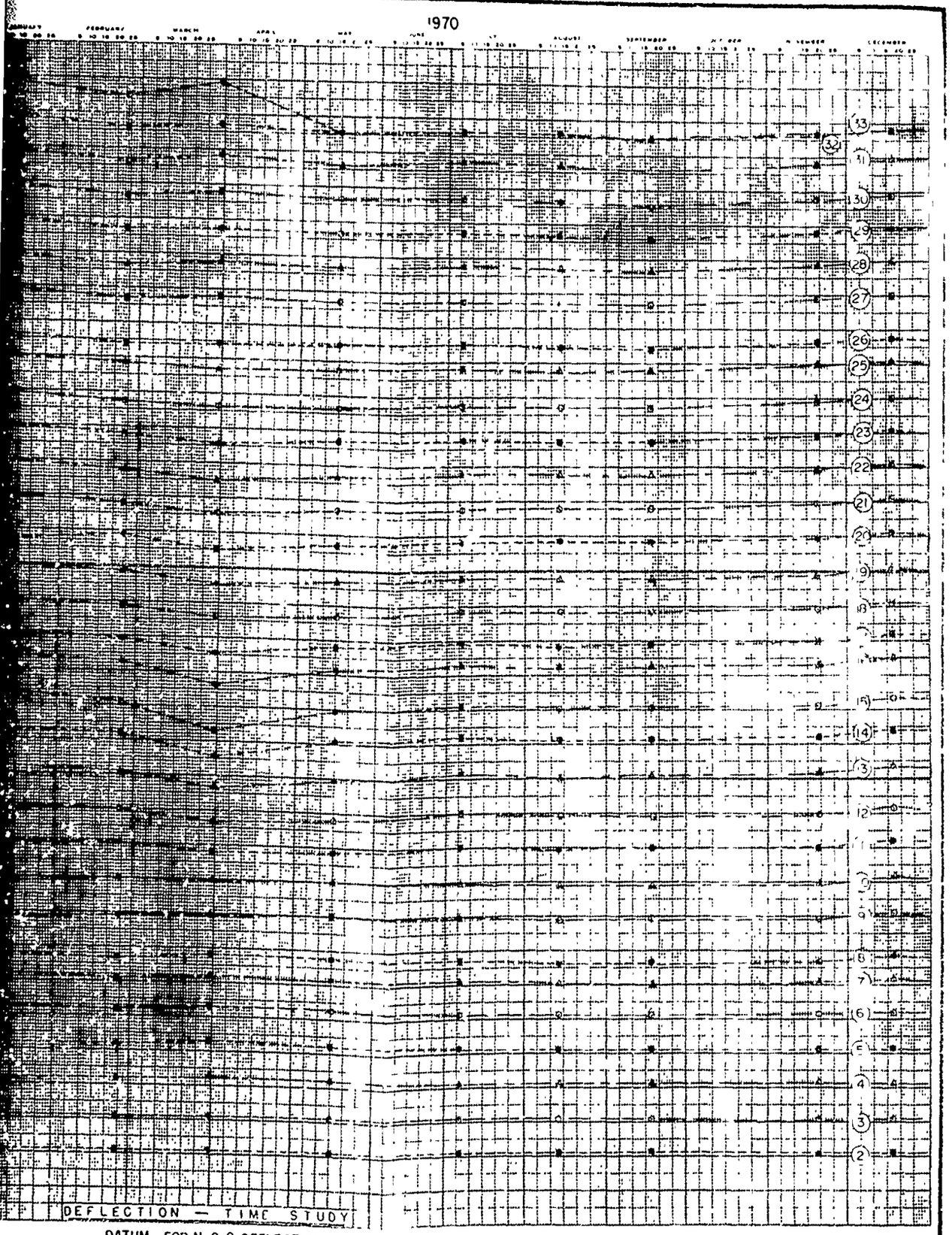
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA E&W
VIF-95-2

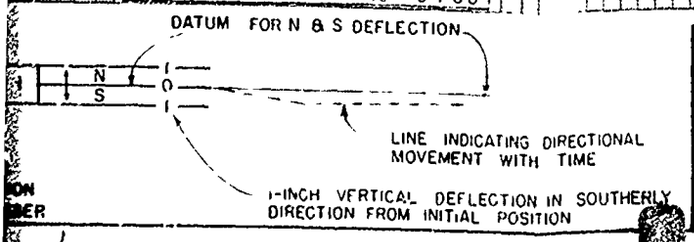
PLATE 34



VERTICAL DEFLECTION

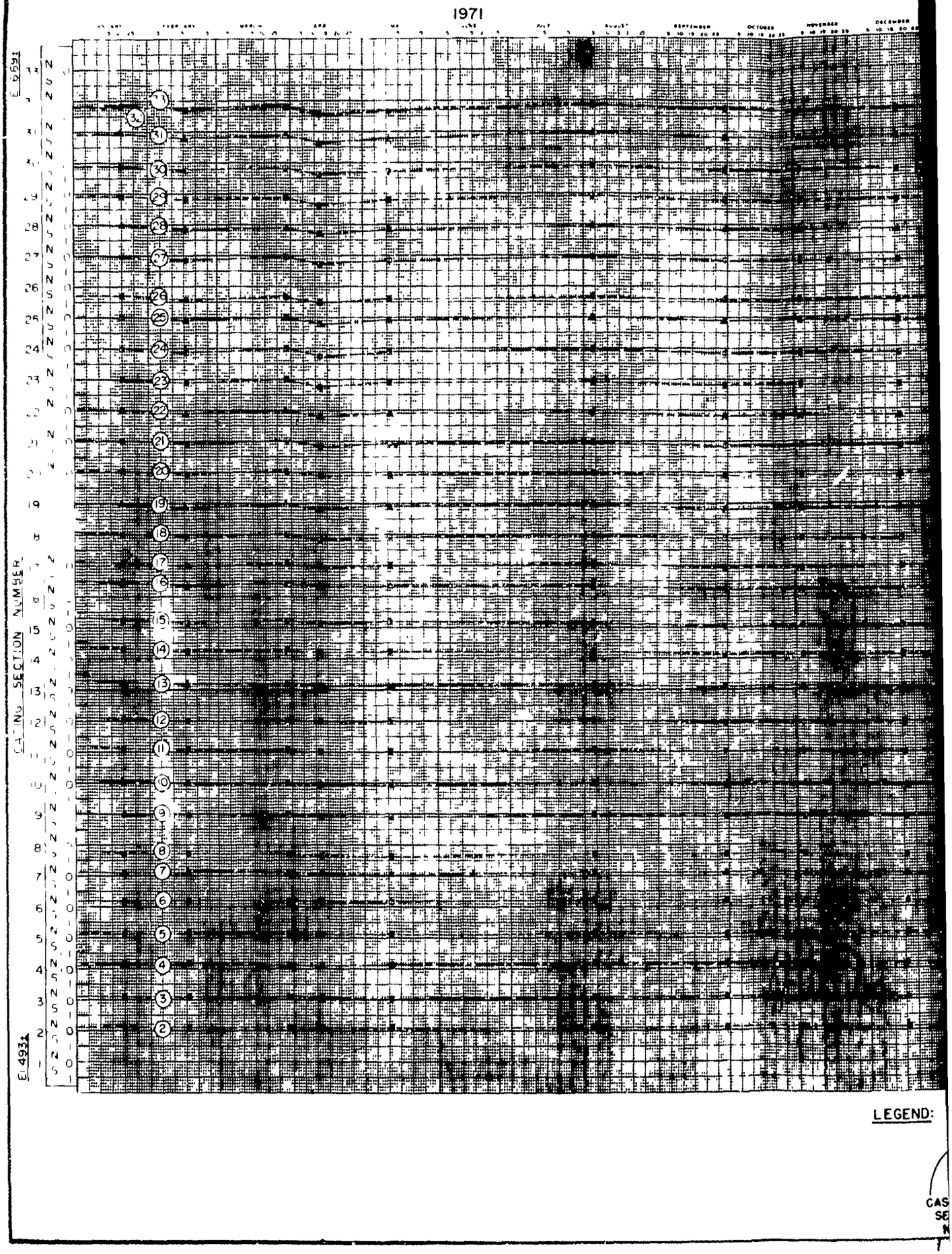
SCALE 1" = 1"

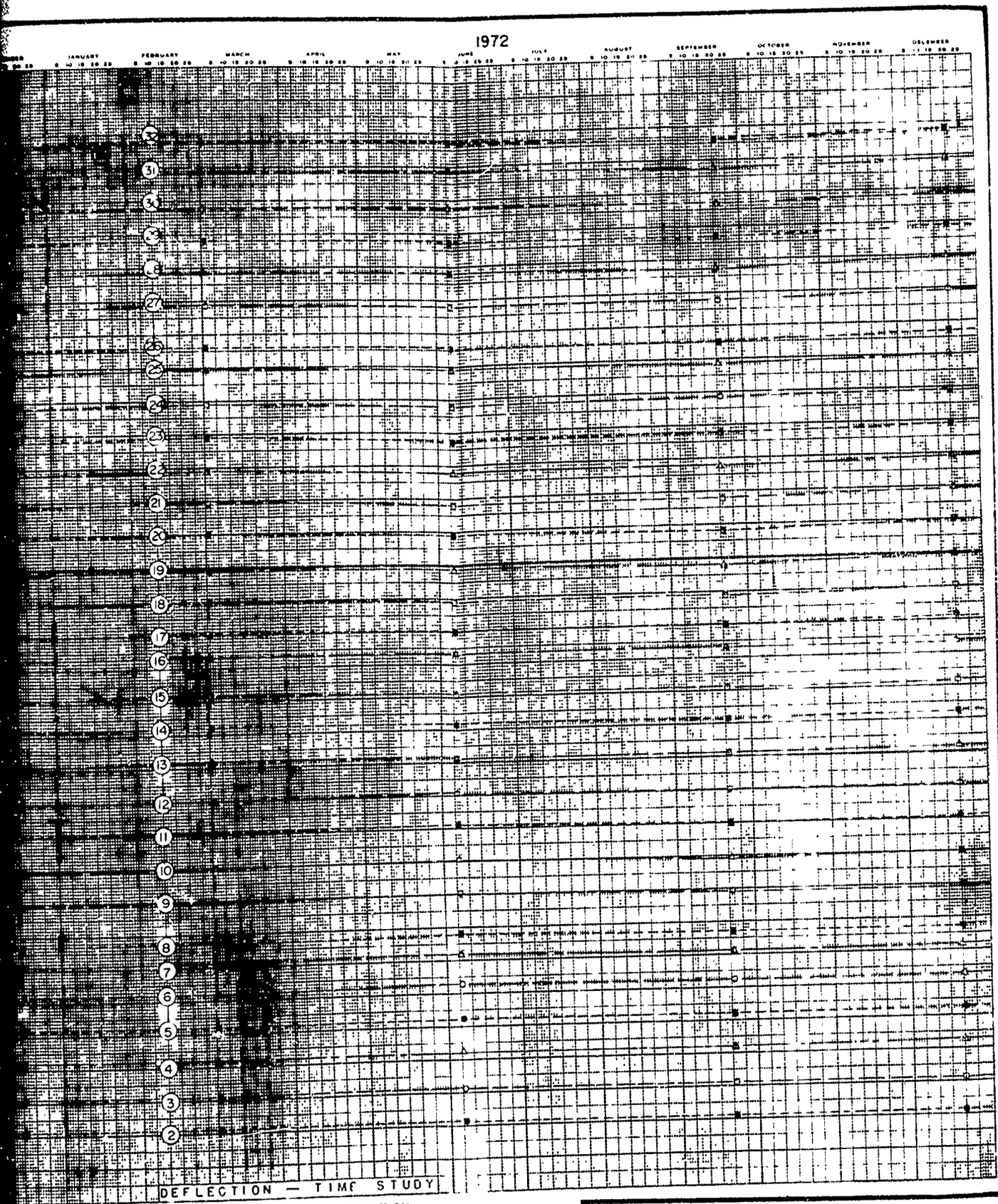




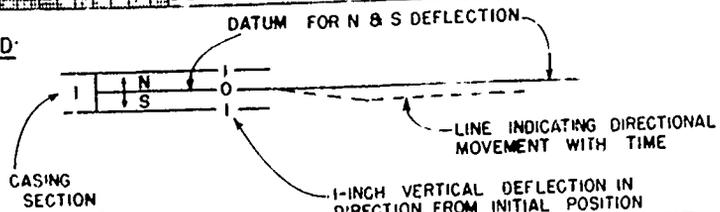
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA N & S
VIF - 95-2

PLATE 35


1971
CASING SECTION NUMBER
EL 6691
EL 4931
LEGEND:



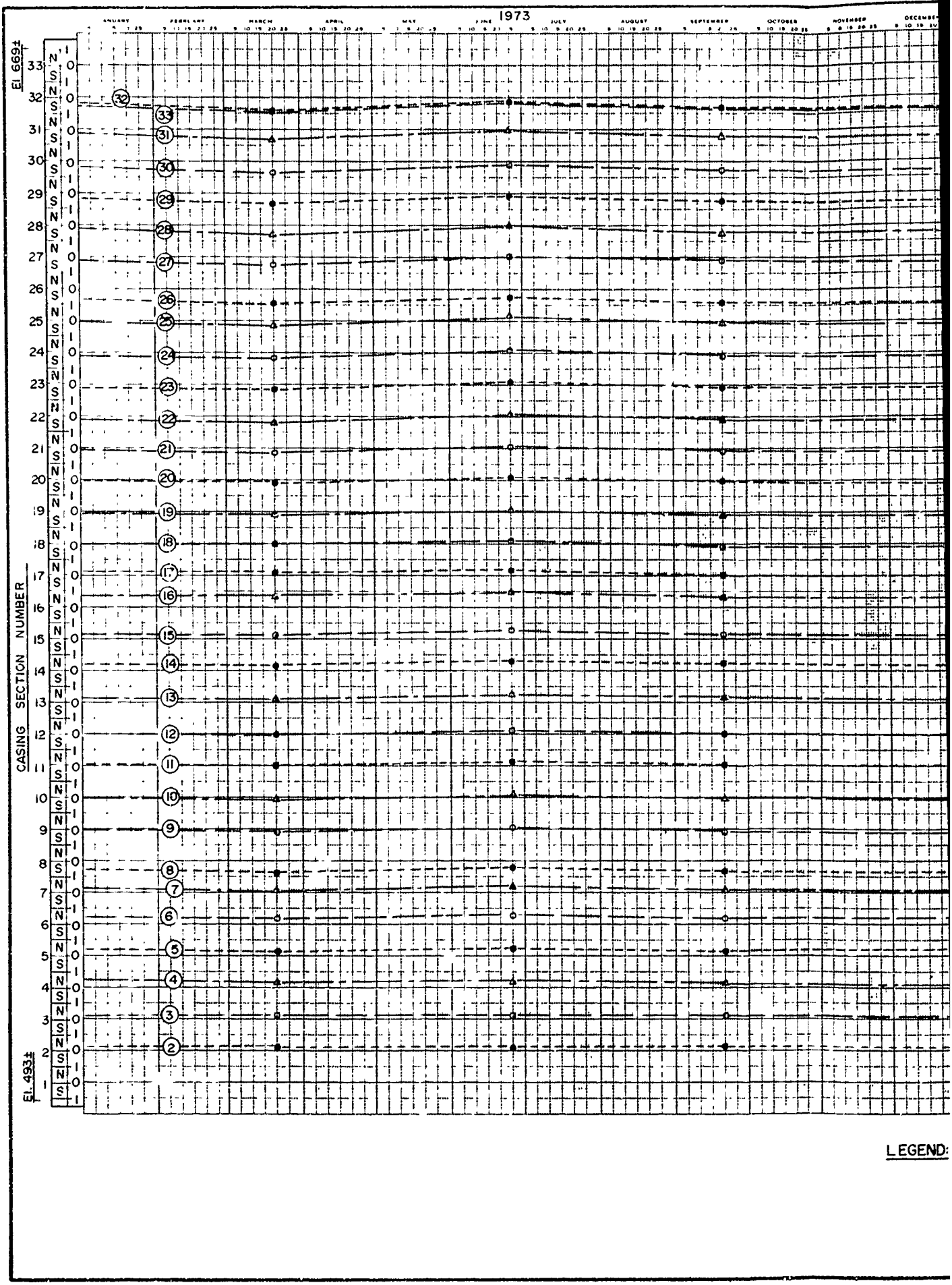
LEGEND



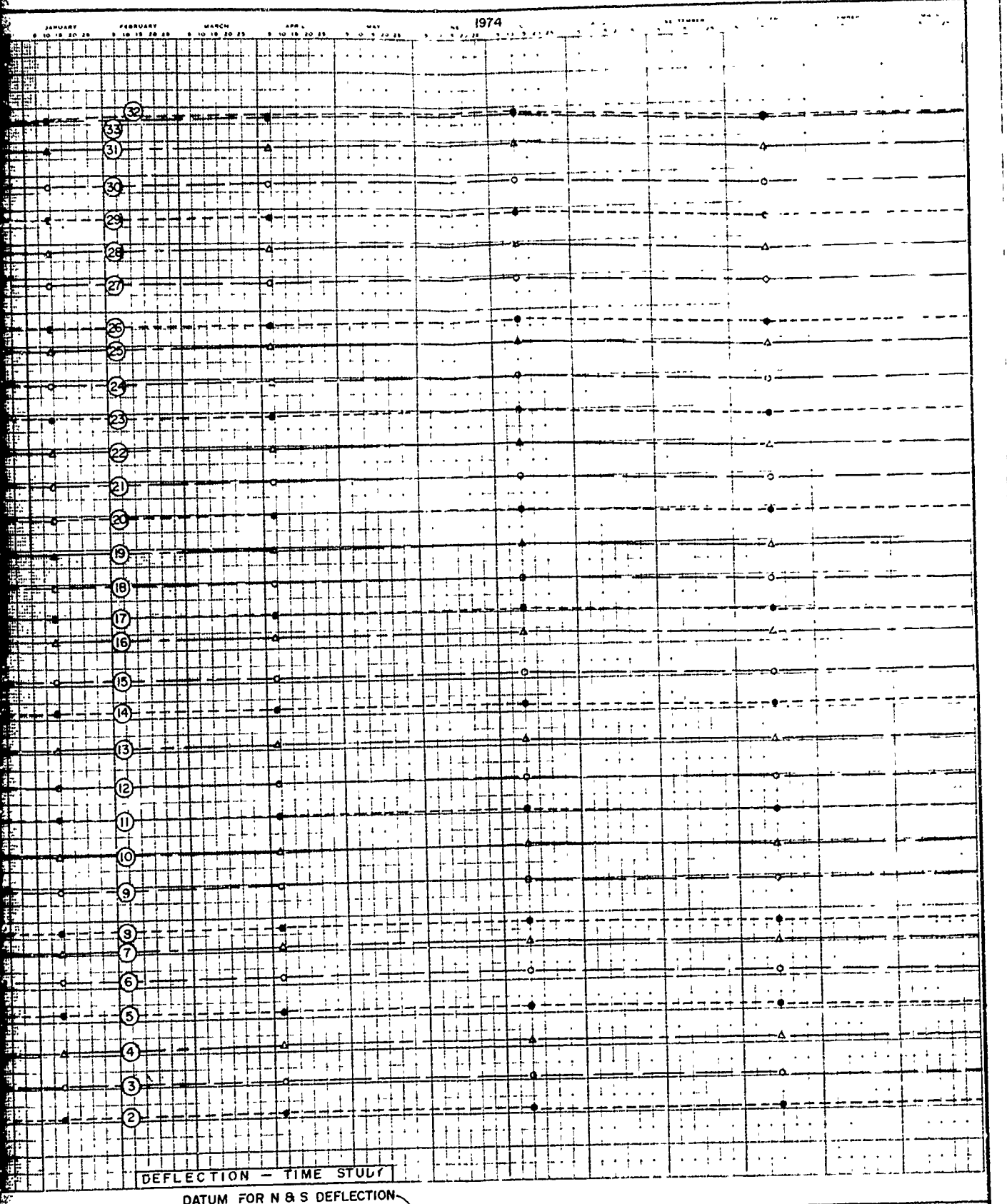
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA N&S
VIF-95-2

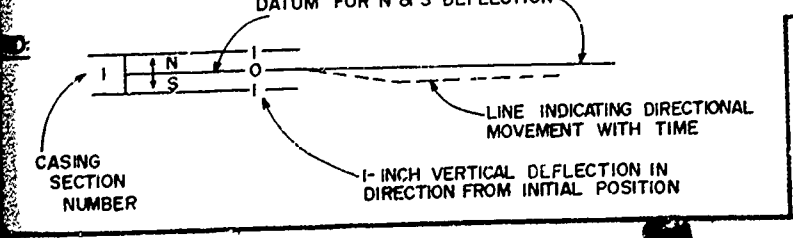
PLATE 36

CORPS OF ENGINEERS



U S ARMY

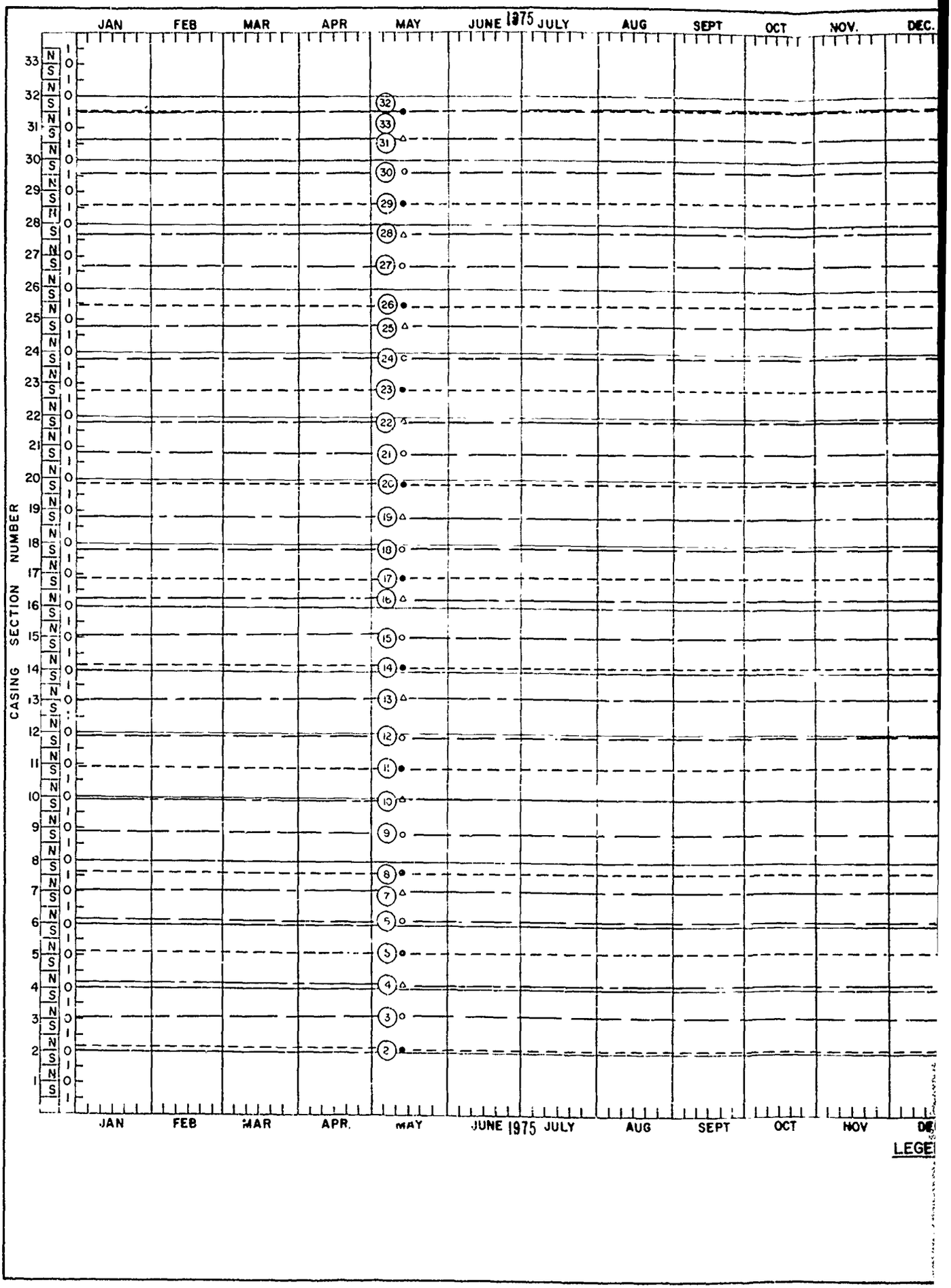




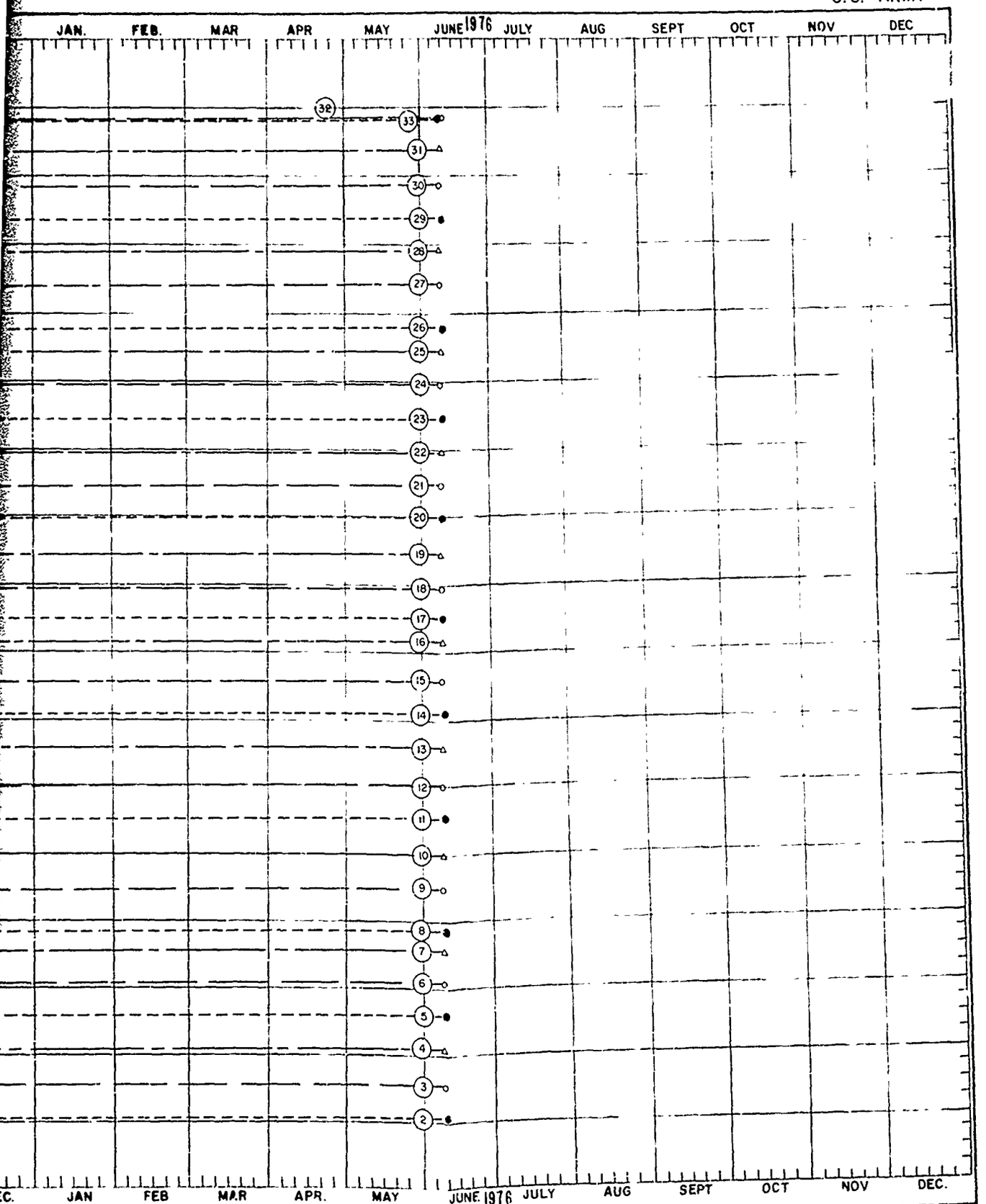
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA N & S
VIF-95-2

PLATE 37

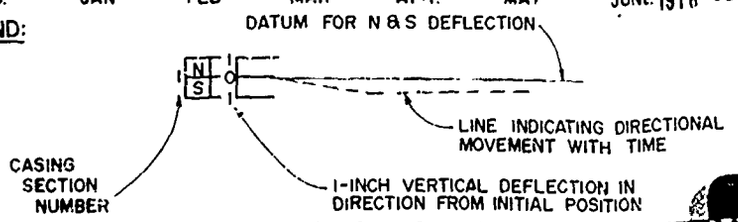
CORPS OF ENGINEERS



U.S. ARMY



GEND:

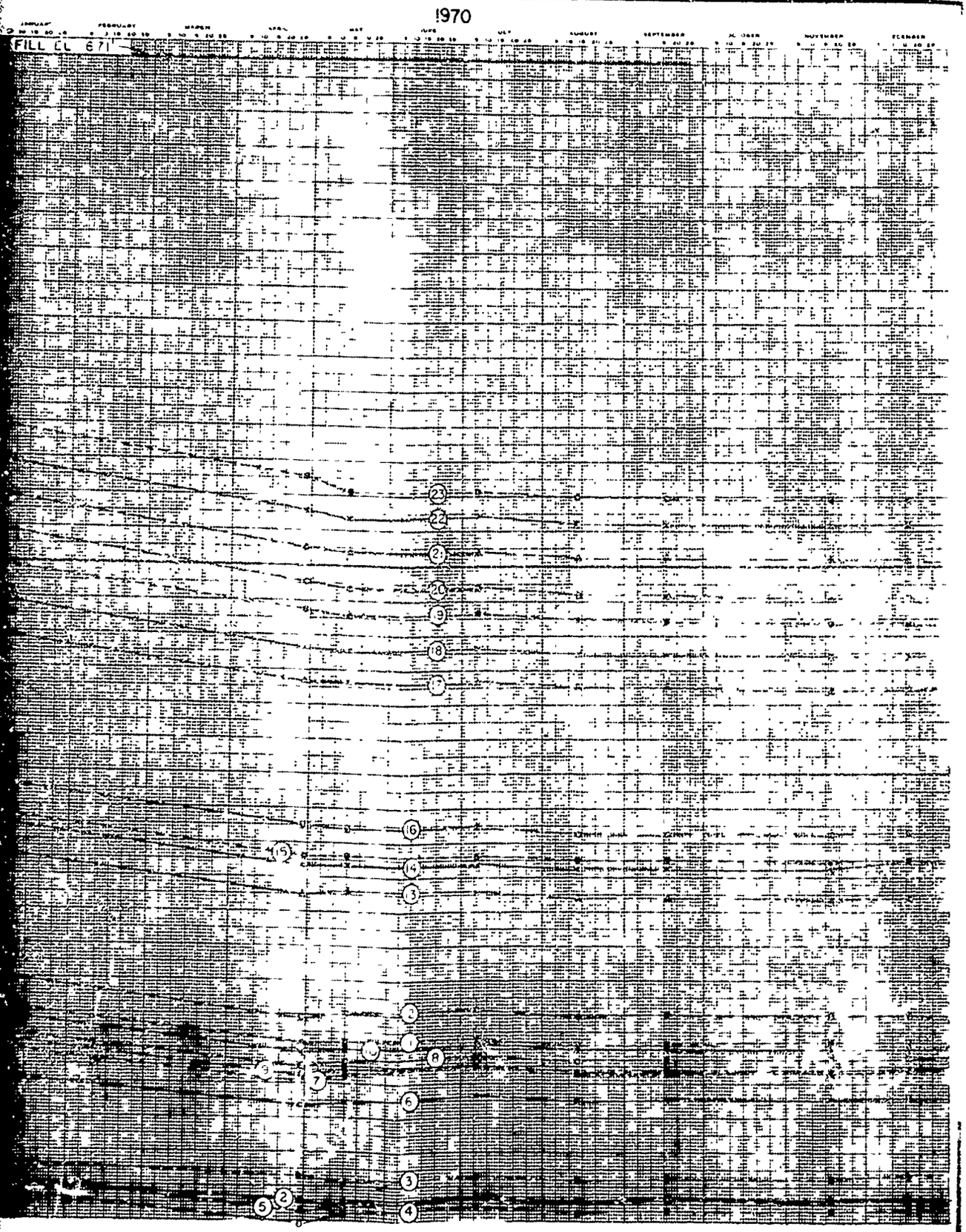


LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.

BELTZVILLE LAKE
VERTICAL DEFLECTION DATA N&S
VIF 95-2

PLATE 38

1969



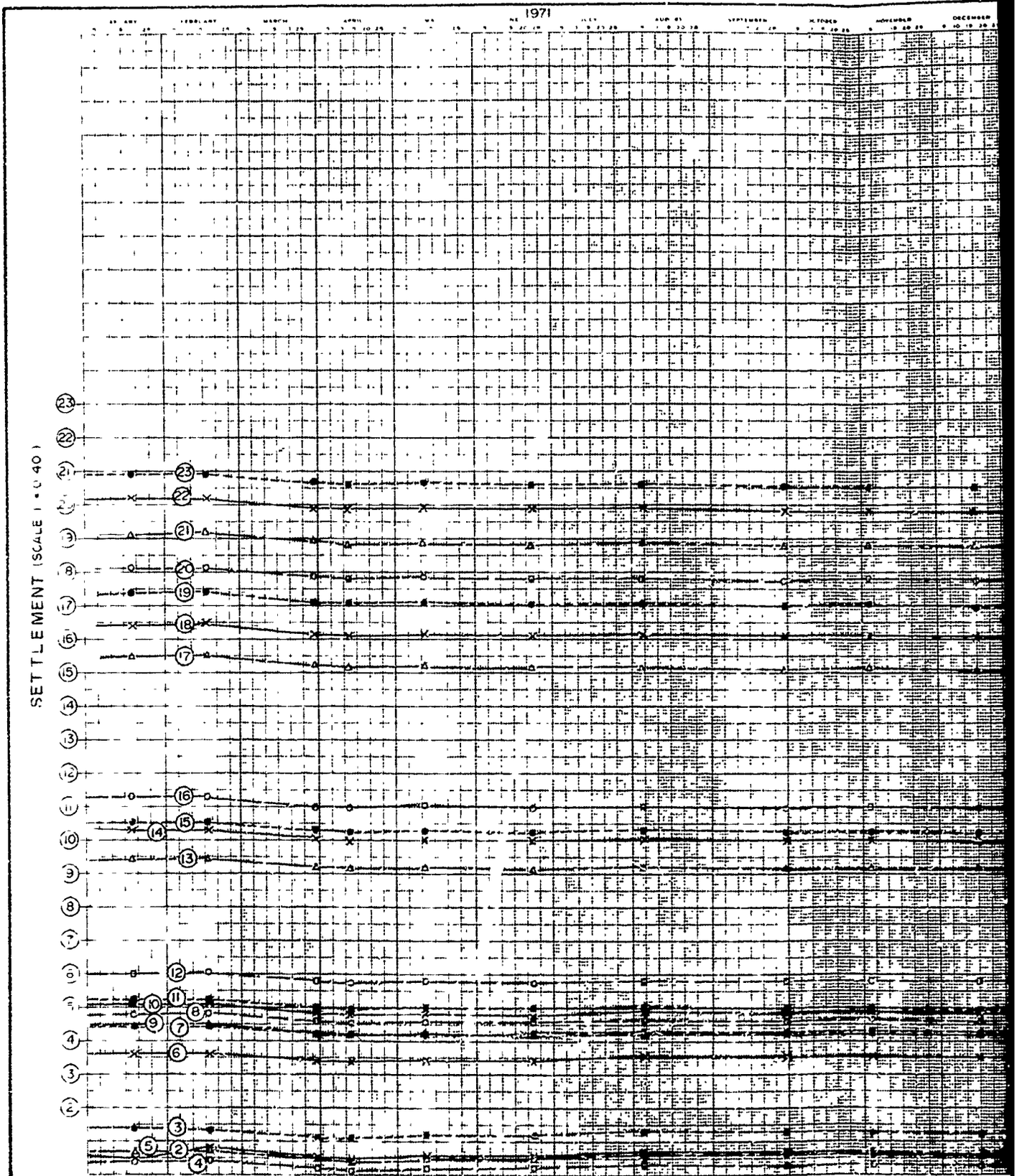
NOTE

555.85 ② = INITIALLY INSTALLED BOTTOM ELEVATION FOR CASING #2

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF-98-5 1969-1970

PLATE 39

CORPS OF ENGINEERS



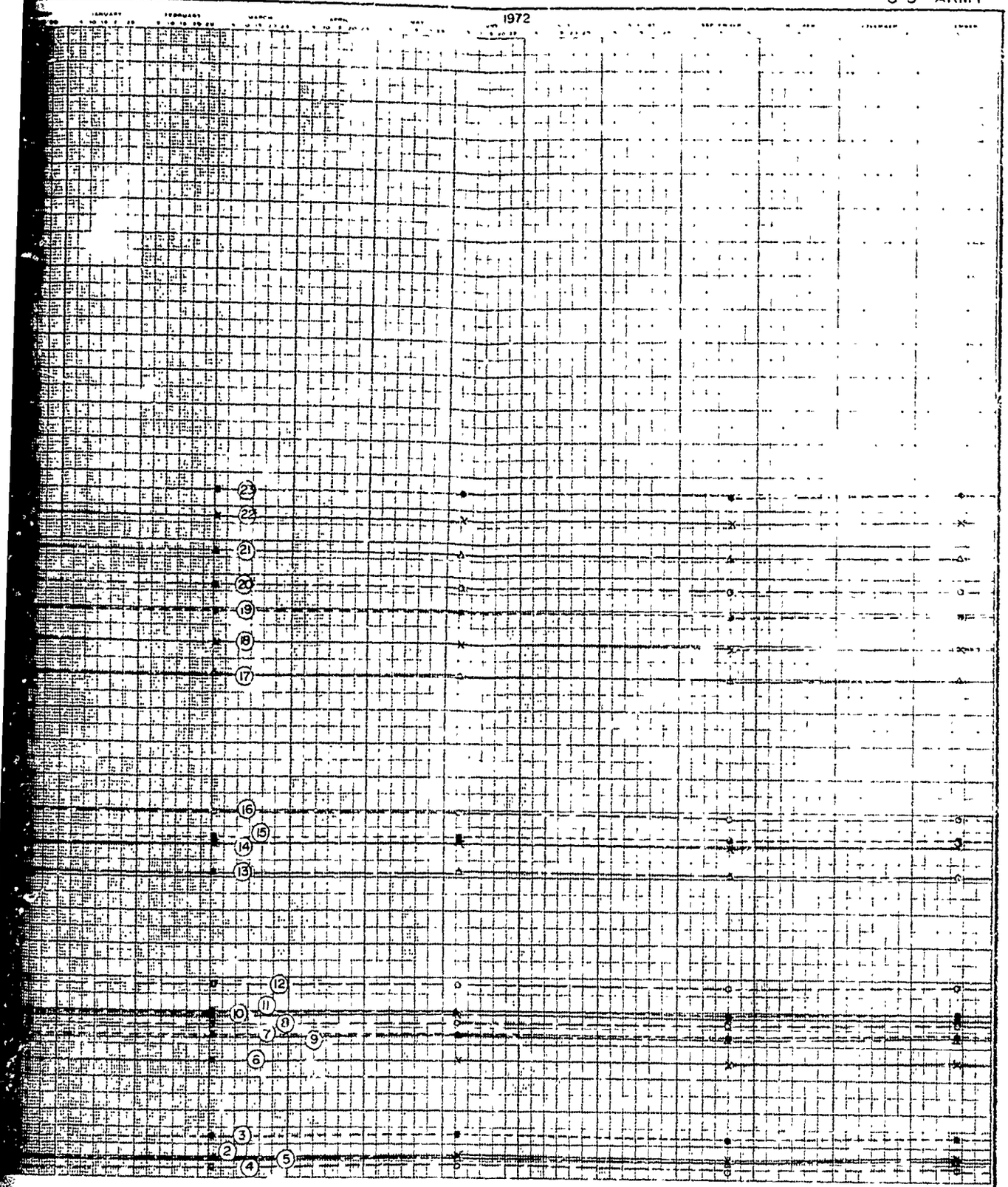
NOTE

Initial datum for settlement of section casing (2)

(2)

Measured settlement in section casing (2)

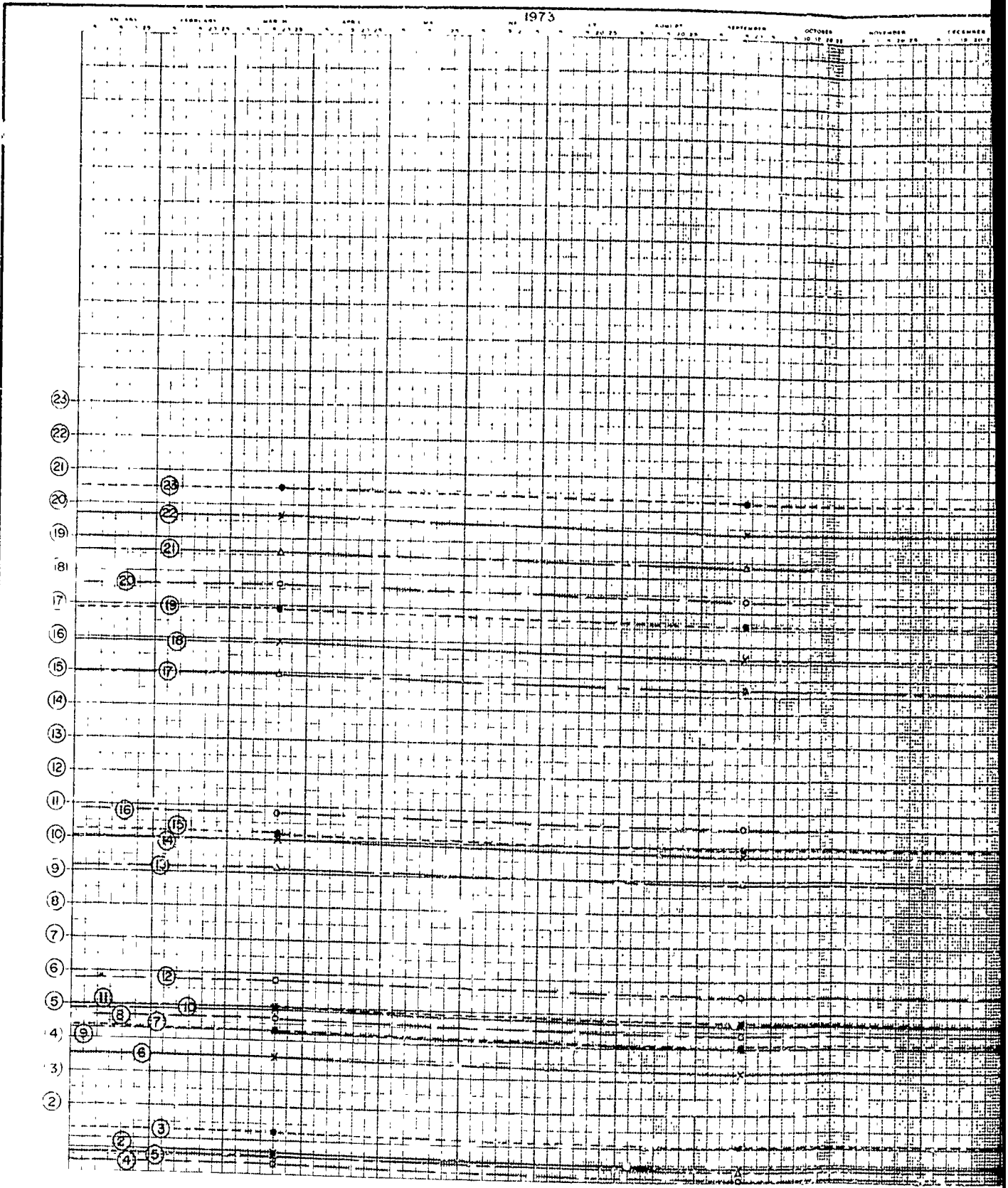
U S ARMY



LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF-98-5 1971-1972

PLATE 40

CORPS OF ENGINEERS



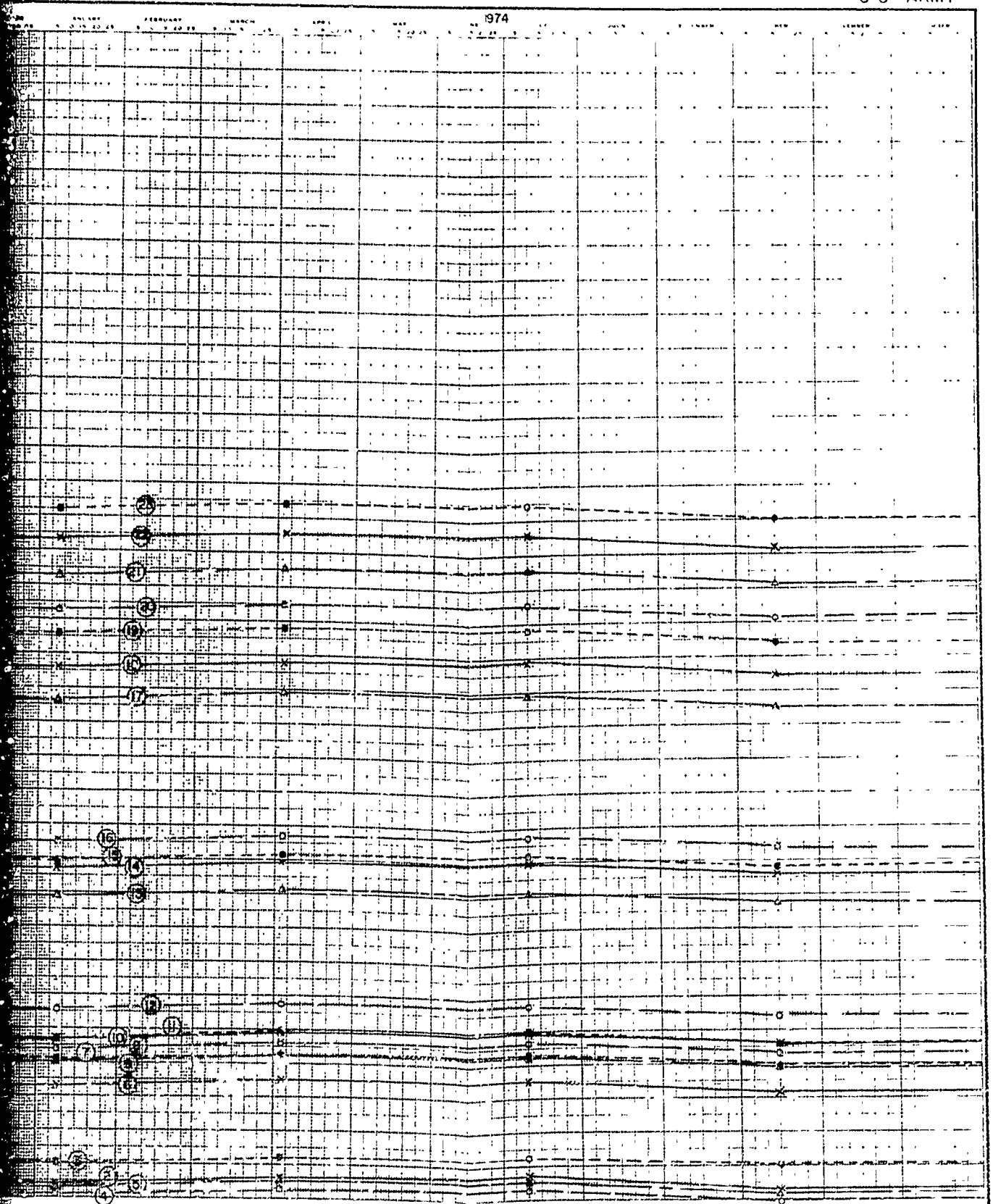
NOTE

Initial datum for settlement of section casing (2)

(2)

Measured settlement in section casing (2)

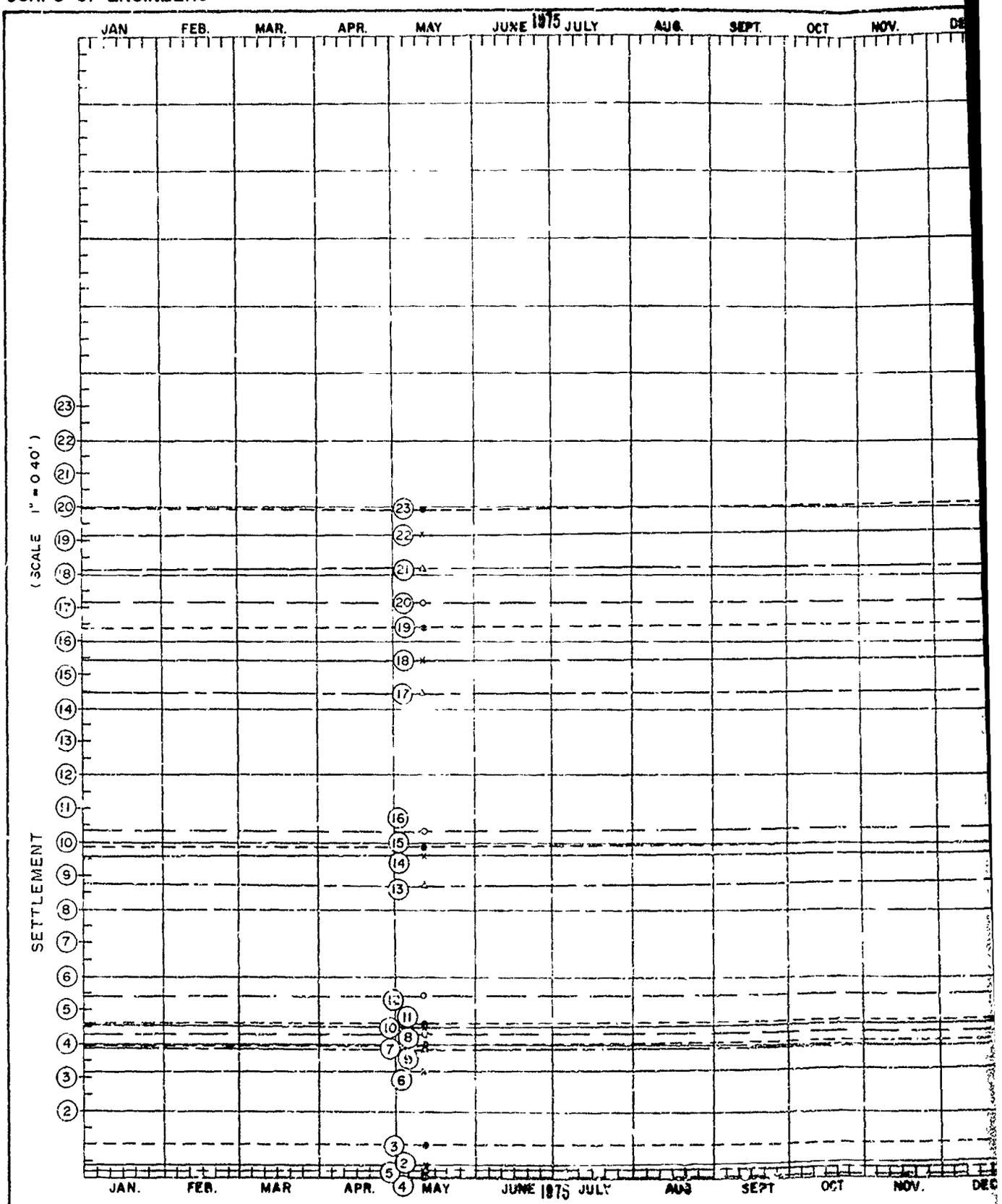
U S ARMY



LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF-98-5 1973-1974

PLATE 41

CORPS OF ENGINEERS

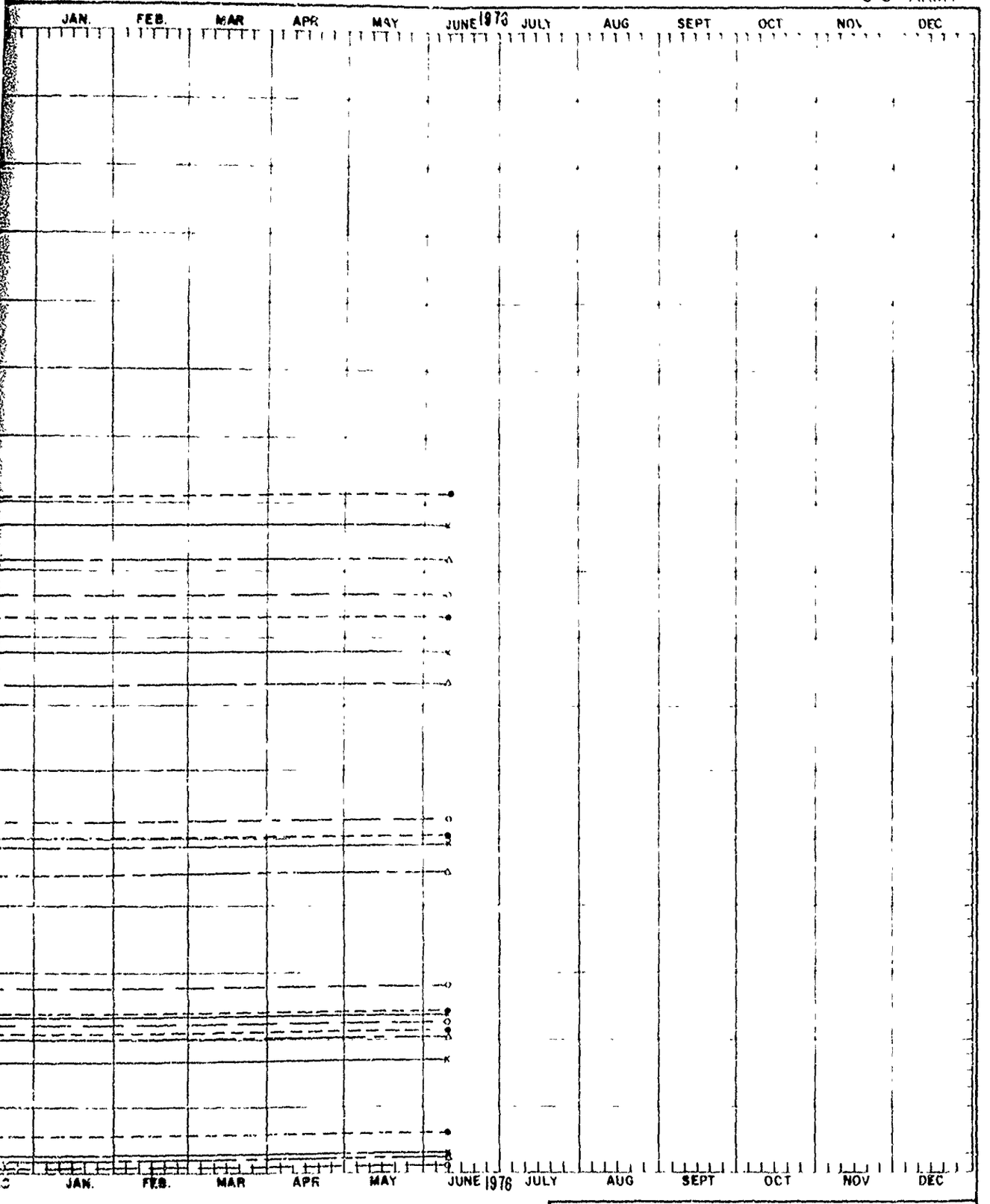


NOTE

Initial datum for settlement of section casing (2)

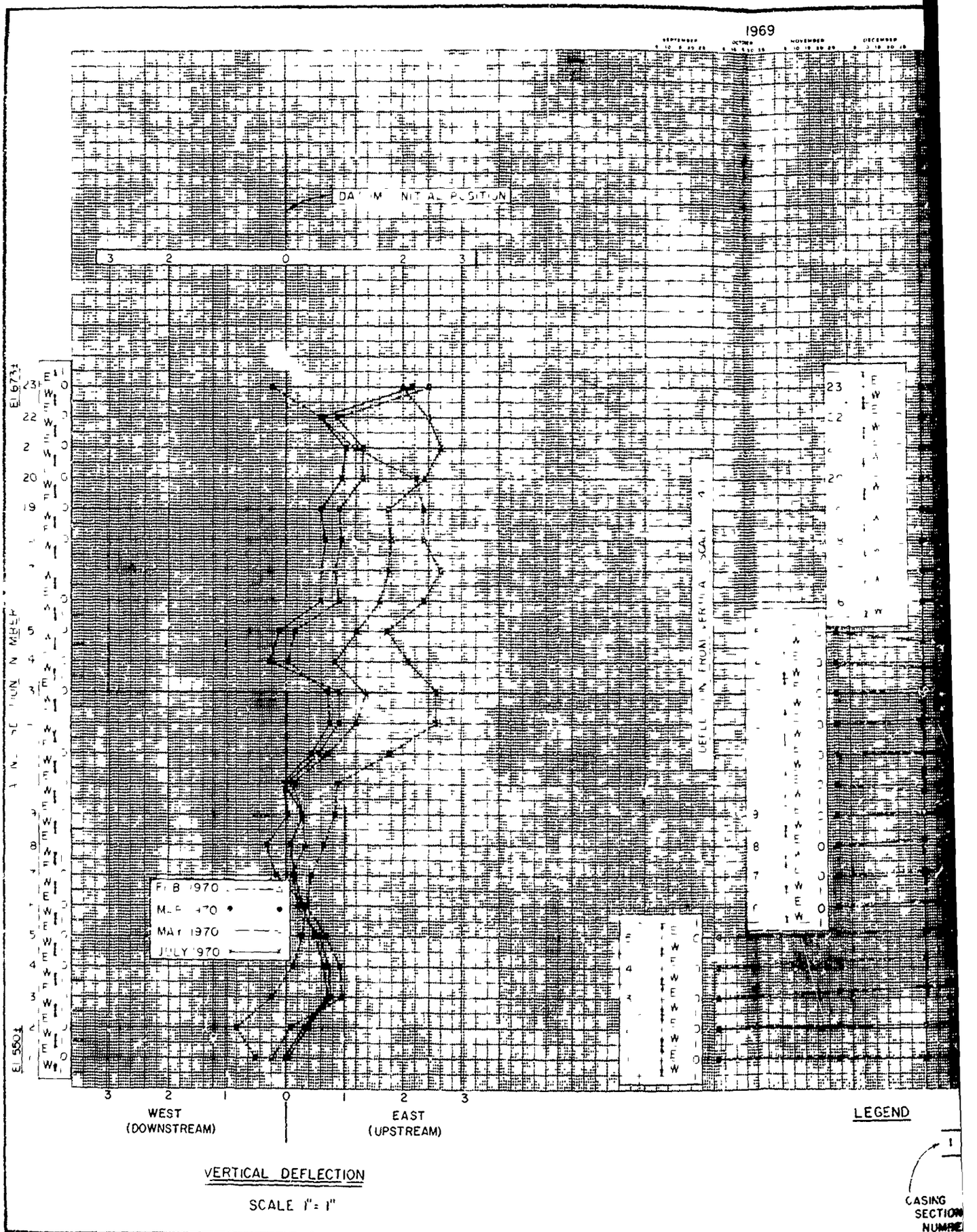
Measured settlement in section casing (2)

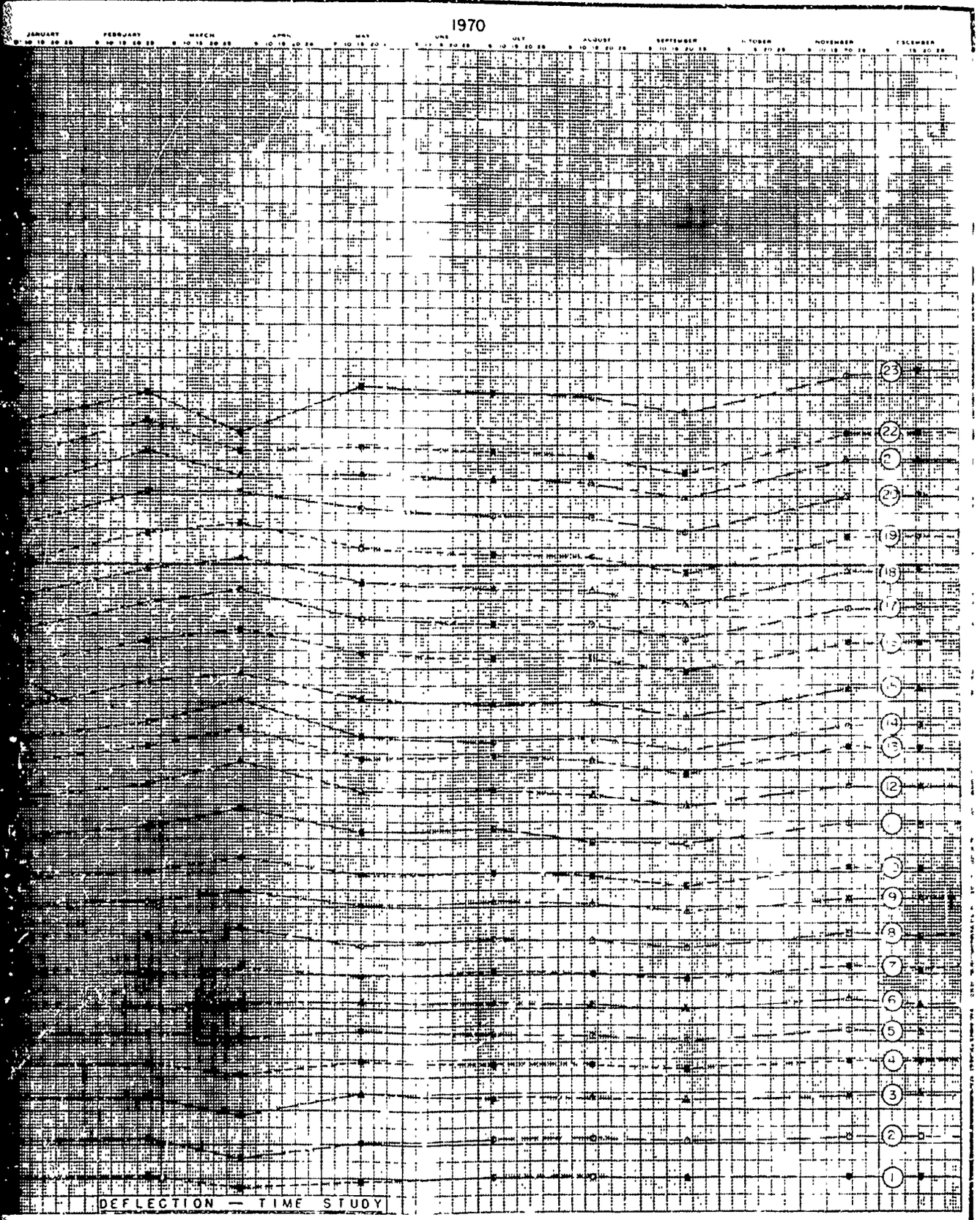
U S ARMY

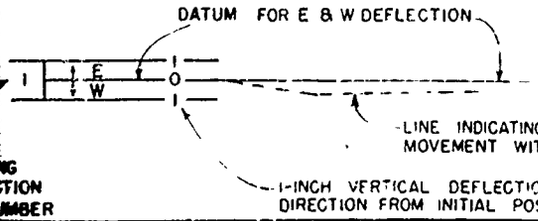


LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF 98-5 1975-1976

PLATE 42

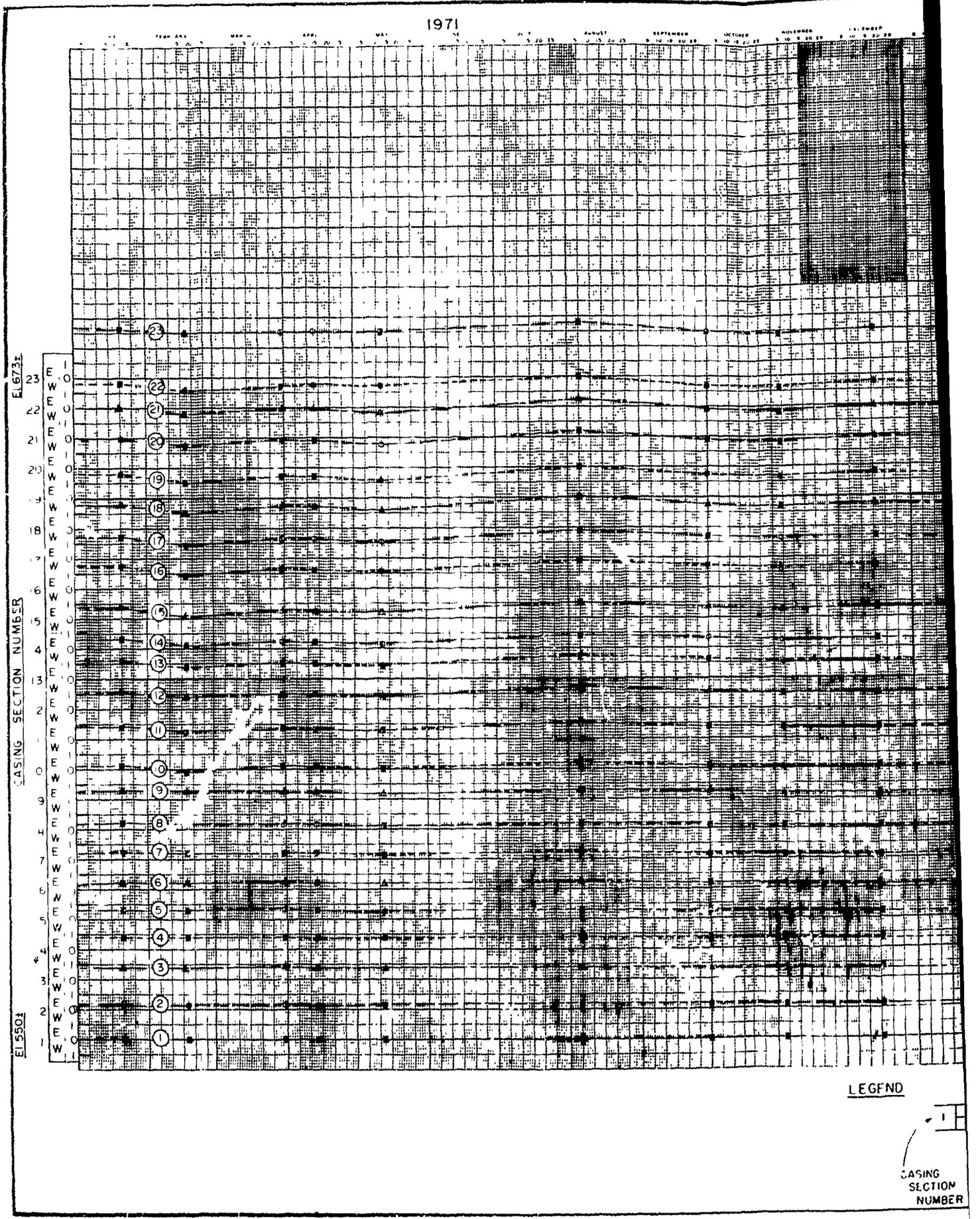

1969
DATUM INITIAL POSITION
3 2 0 2 3
EL 673
EL 550
FEB 1970
MAR 1970
MAY 1970
JULY 1970
3 2 1 0 1 2 3
WEST
(DOWNSTREAM)
EAST
(UPSTREAM)
LEGEND
VERTICAL DEFLECTION
SCALE 1" = 1"
CASING
SECTION
NUMBER

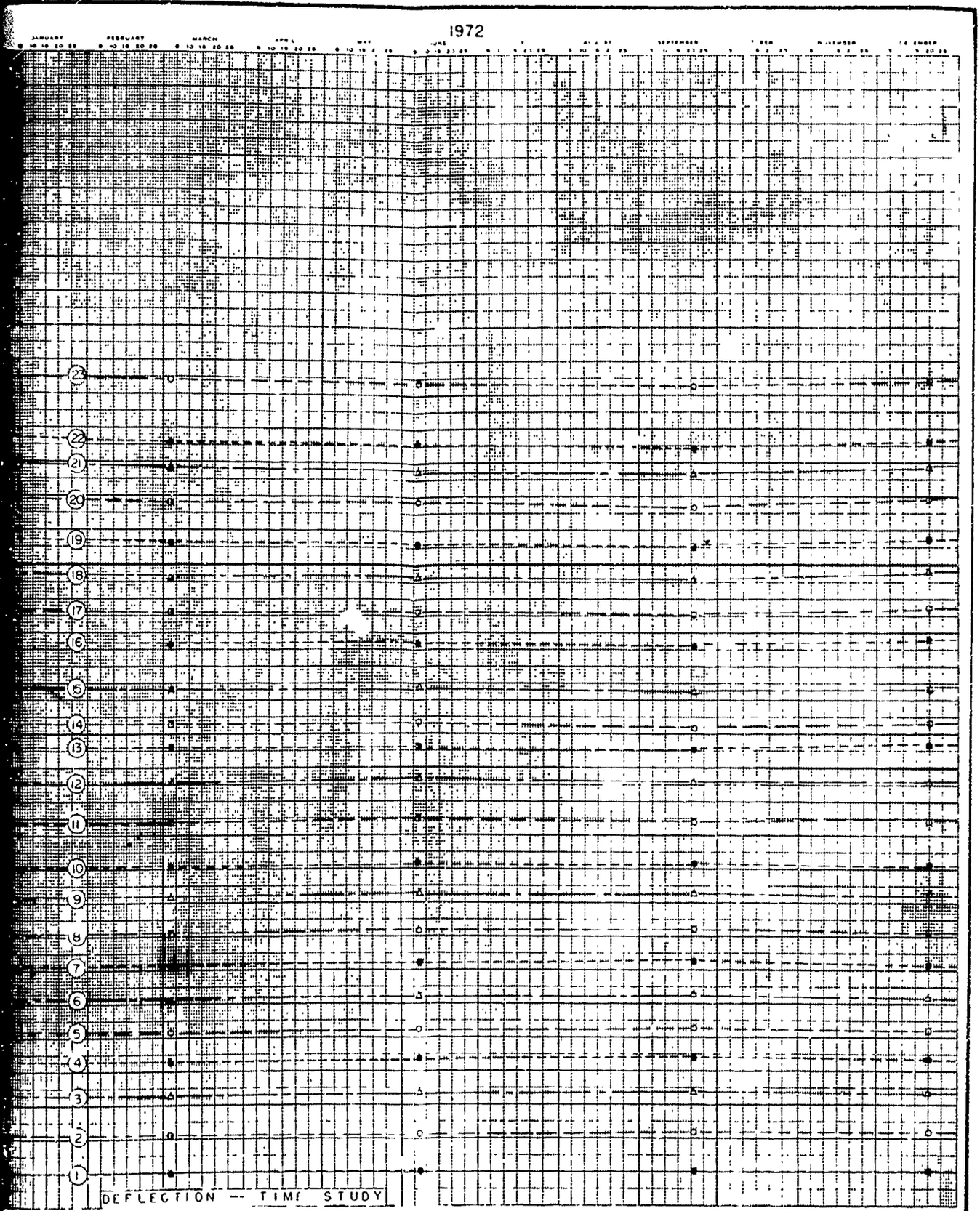




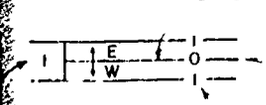
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA-E&W
VIF-98-5

PLATE 43


1971
CASING SECTION NUMBER
EL 6731
EL 5501
LEGEND
CASING SECTION NUMBER



DATUM FOR E & W DEFLECTION



LINE INDICATING DIRECTIONAL MOVEMENT WITH TIME

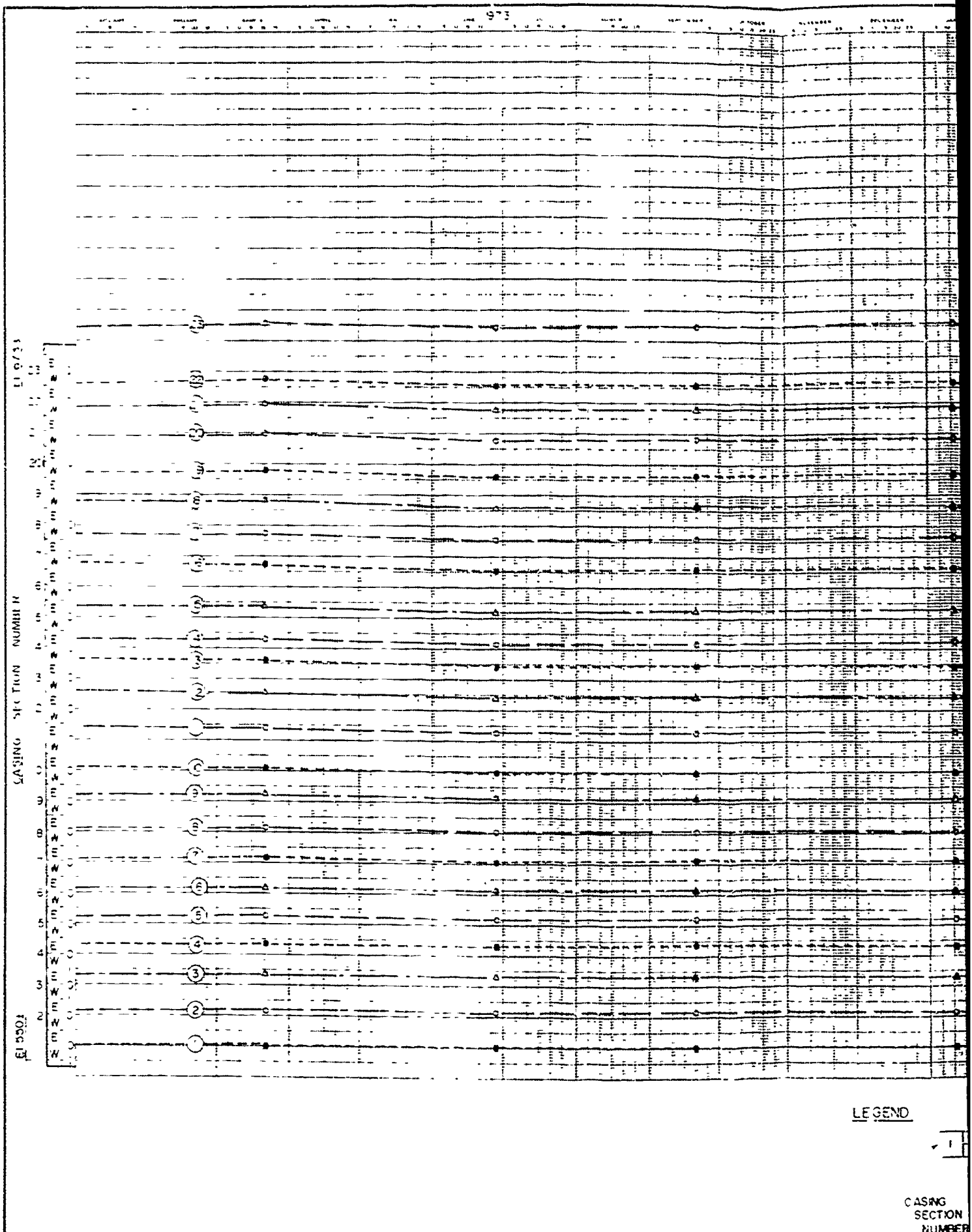
1-INCH VERTICAL DEFLECTION IN DIRECTION FROM INITIAL POSITION

ING
CTION
UMBER

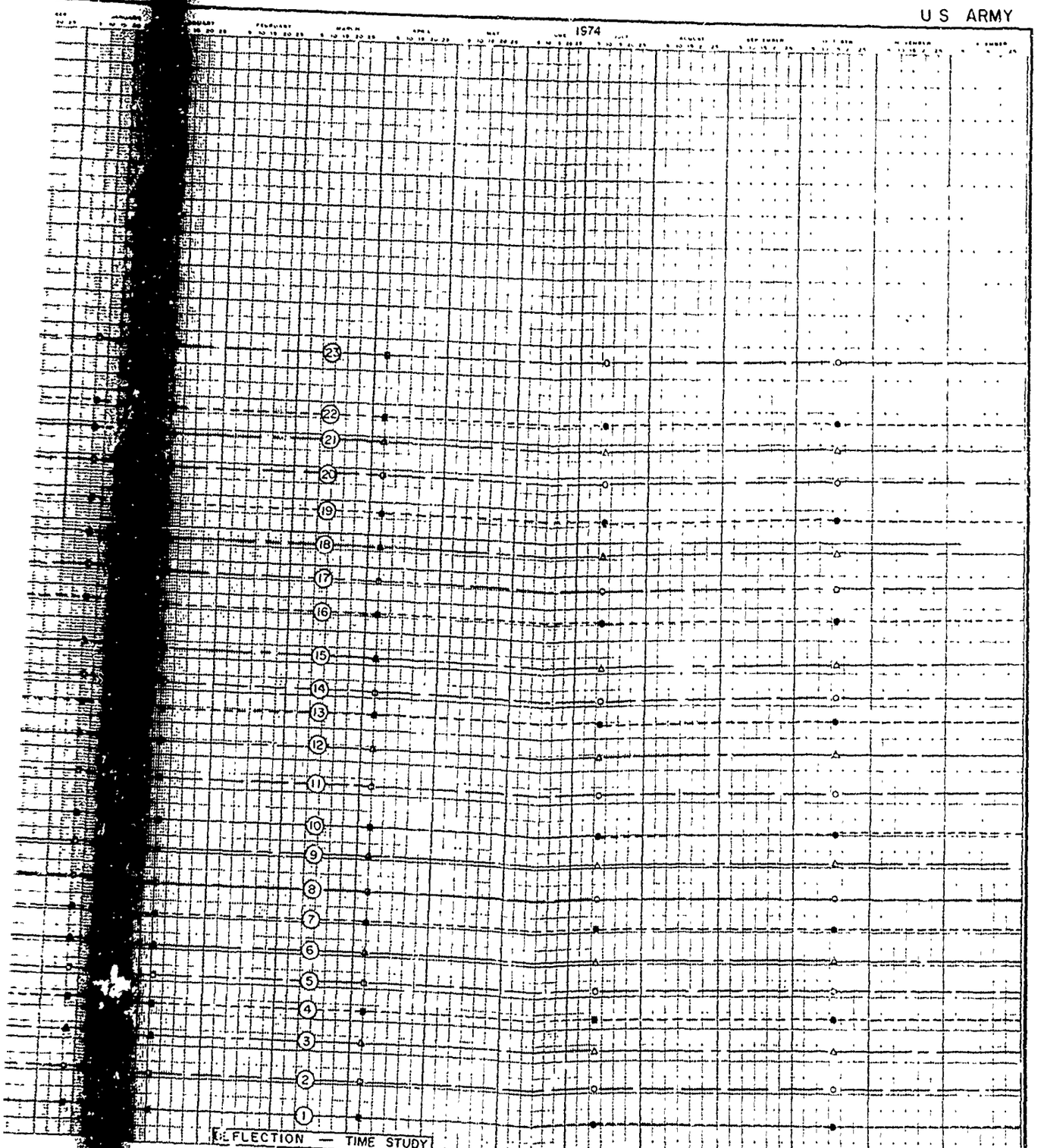
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.

BELTZVILLE LAKE
VERTICAL DEFLECTION DATA E & W
VIF-98-5

PLATE 44


CASING SECTION NUMBER
LEGEND
CASING
SECTION
NUMBER

U S ARMY



DATUM FOR E & W DEFLECTION

E
W

LINE INDICATING DIRECTIONAL MOVEMENT WITH TIME

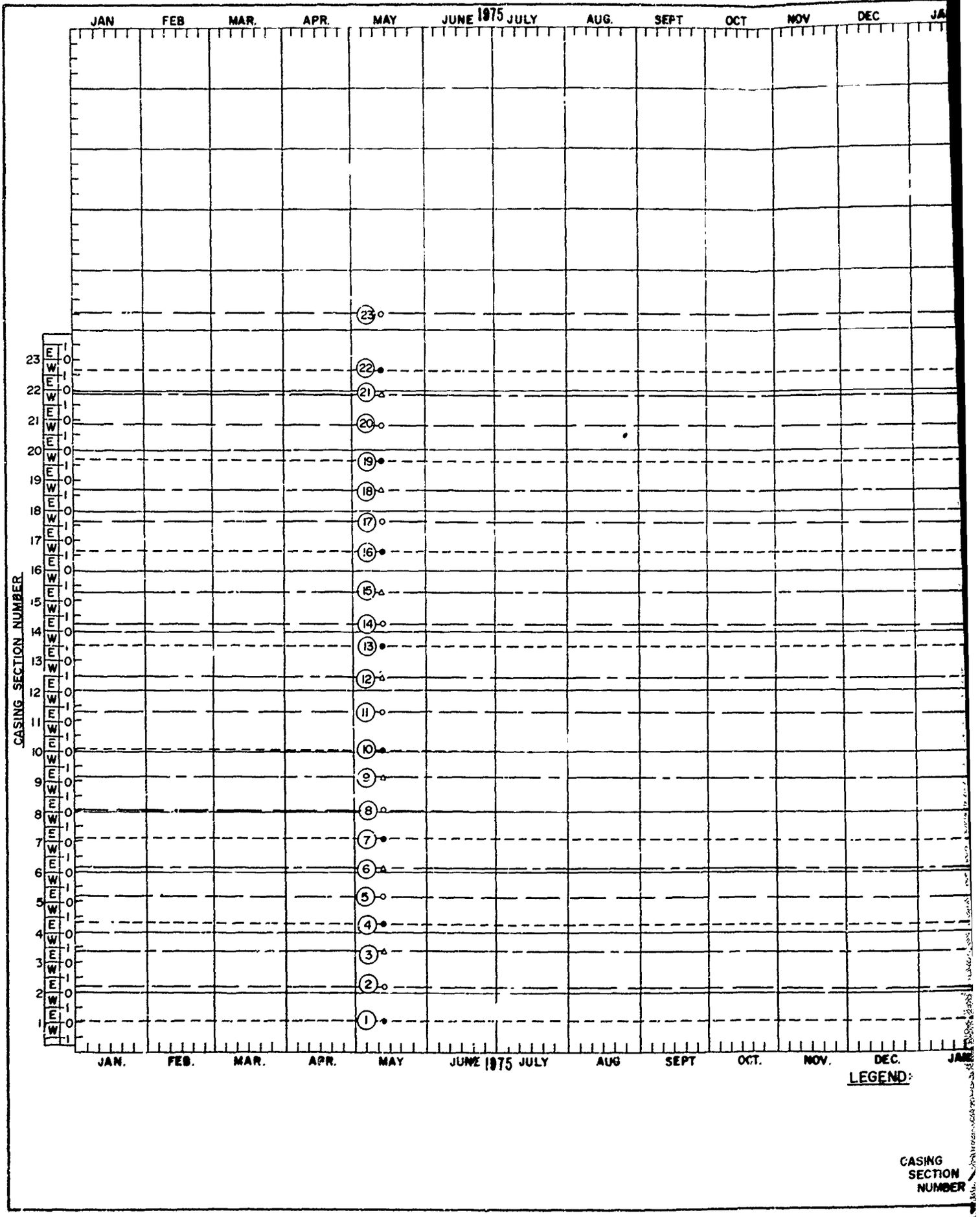
1-INCH VERTICAL DEFLECTION IN DIRECTION FROM INITIAL POSITION

CASING SECTION NUMBER

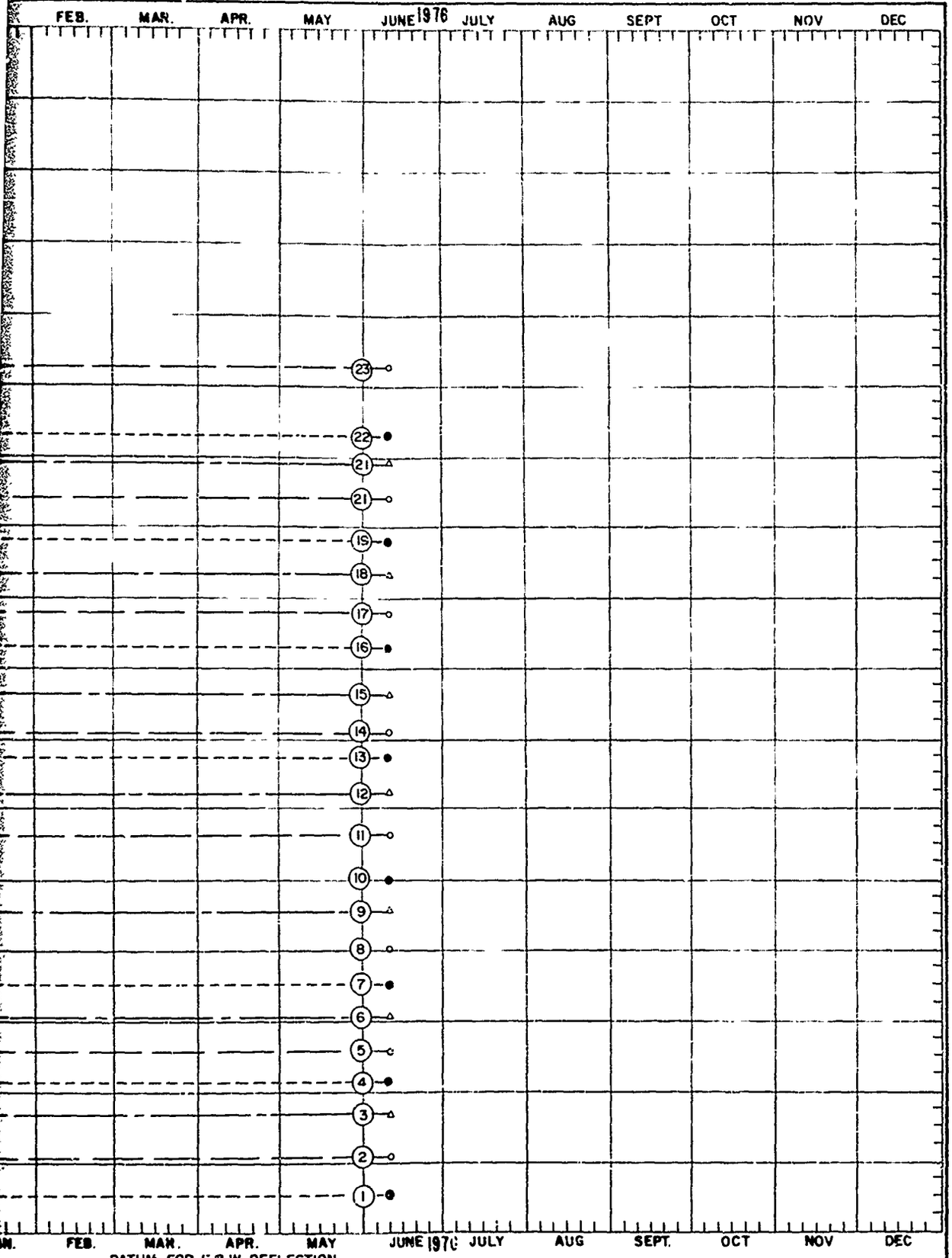
LEHIGH RIVER BASIN
POHOPOCO CREEK, P.
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA E & W
VIF-98-5

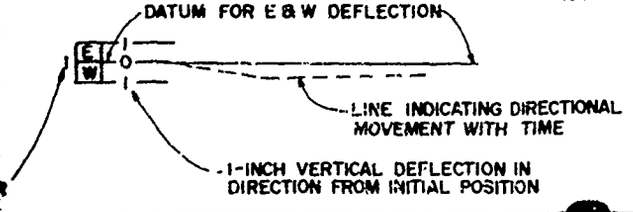
PLATE 45

CORPS OF ENGINEERS



U.S. ARMY

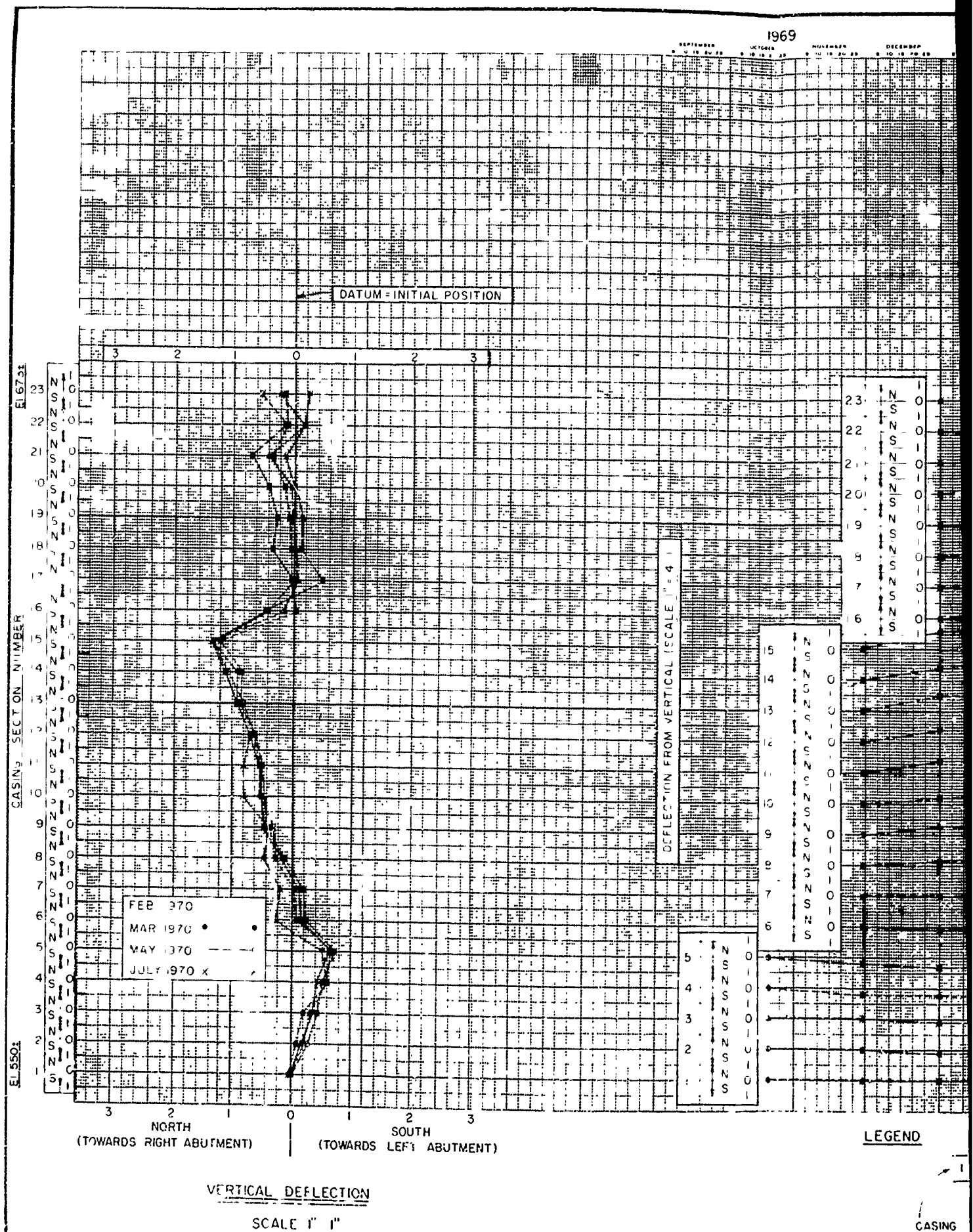


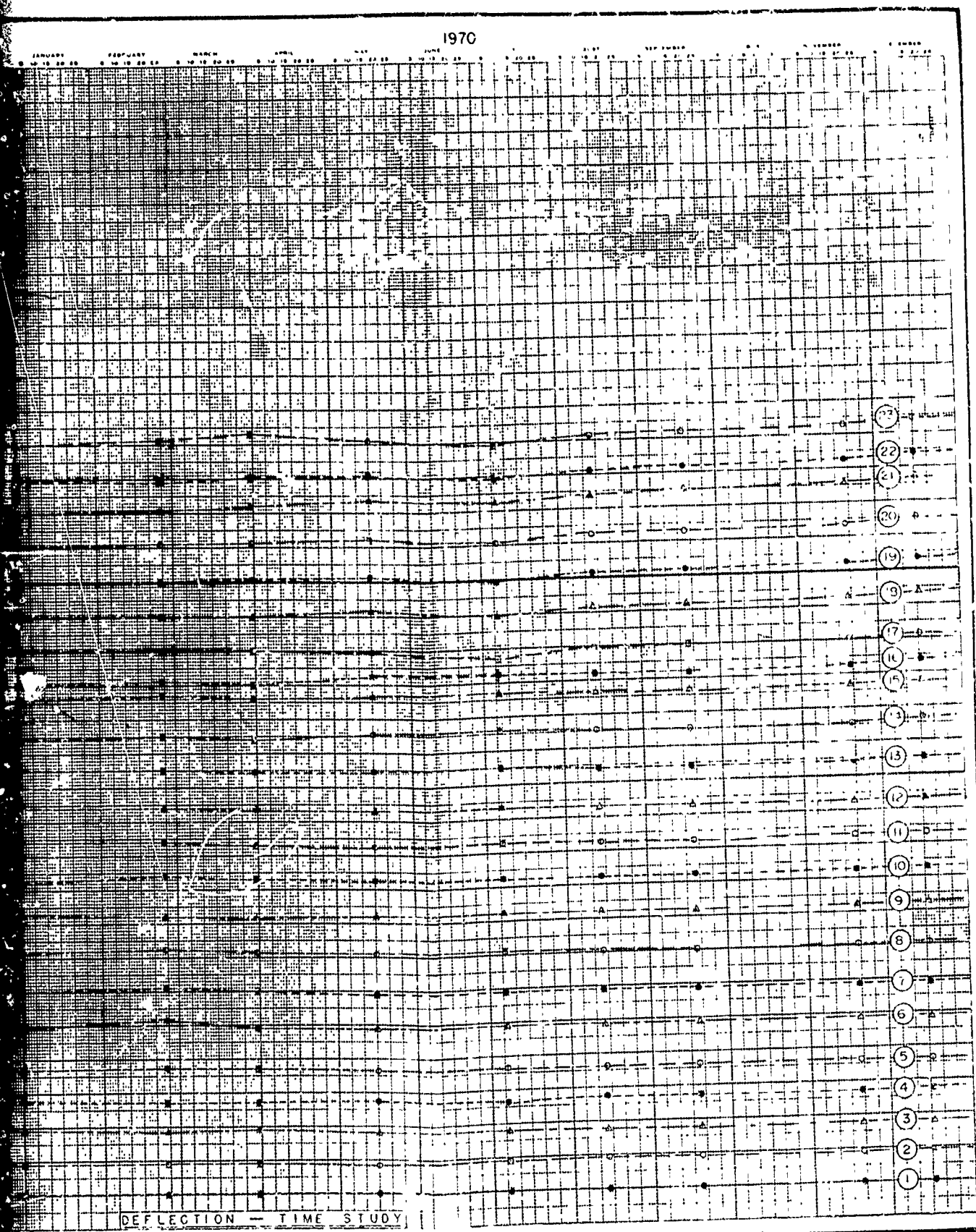


LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.

BELTZVILLE LAKE
VERTICAL DEFLECTION DATA E&W
VIF 98-5

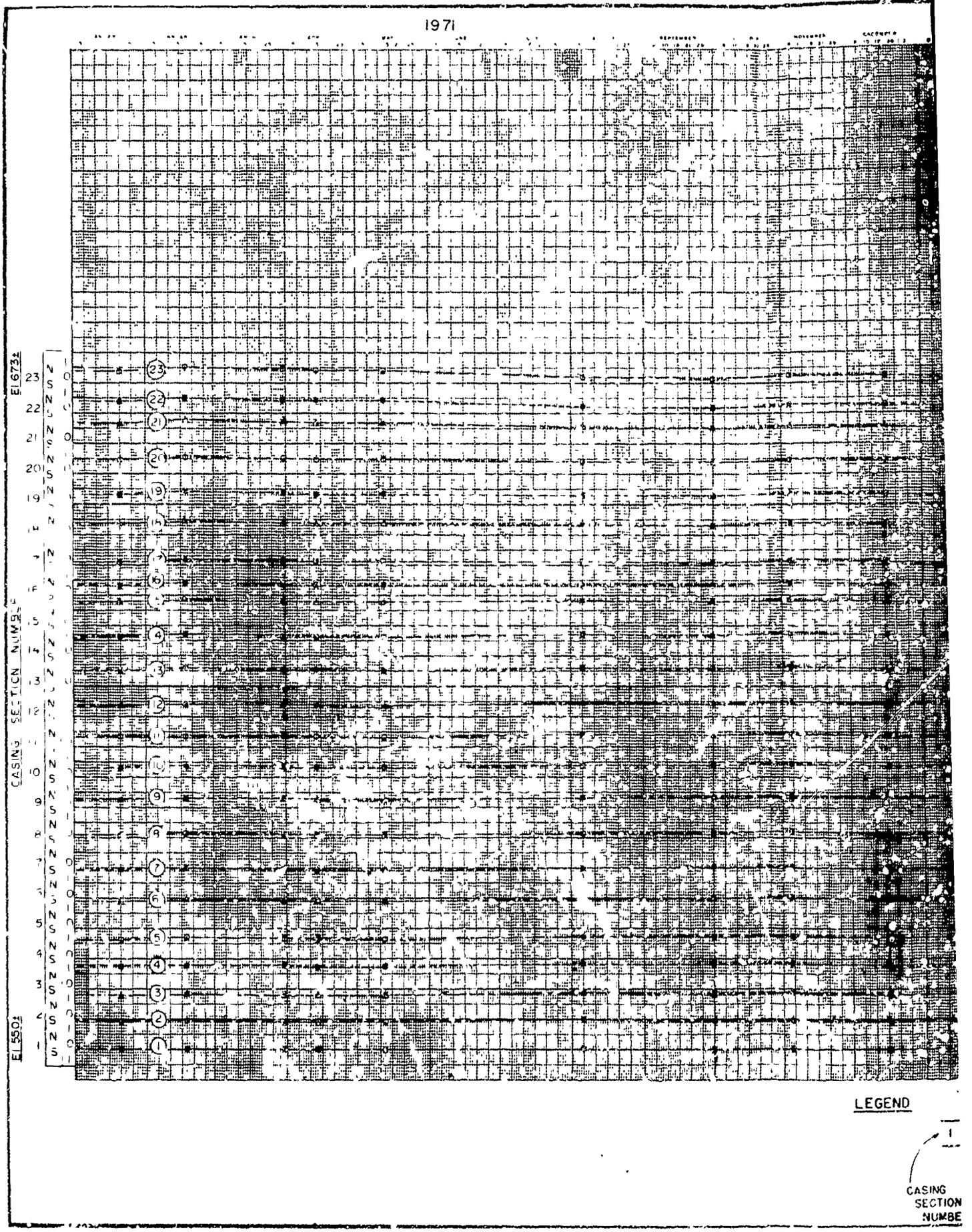
PLATE 46


1969
DATUM = INITIAL POSITION
EL 672±
EL 550±
CASING SECTION NUMBER
DEFLECTION FROM VERTICAL (SCALE 1" = 4')
FEB 1970
MAR 1970
MAY 1970
JULY 1970 x
NORTH
(TOWARDS RIGHT ABUTMENT)
SOUTH
(TOWARDS LEFT ABUTMENT)
LEGEND
VERTICAL DEFLECTION
SCALE 1" 1"
CASING
SECTION
NUMBE

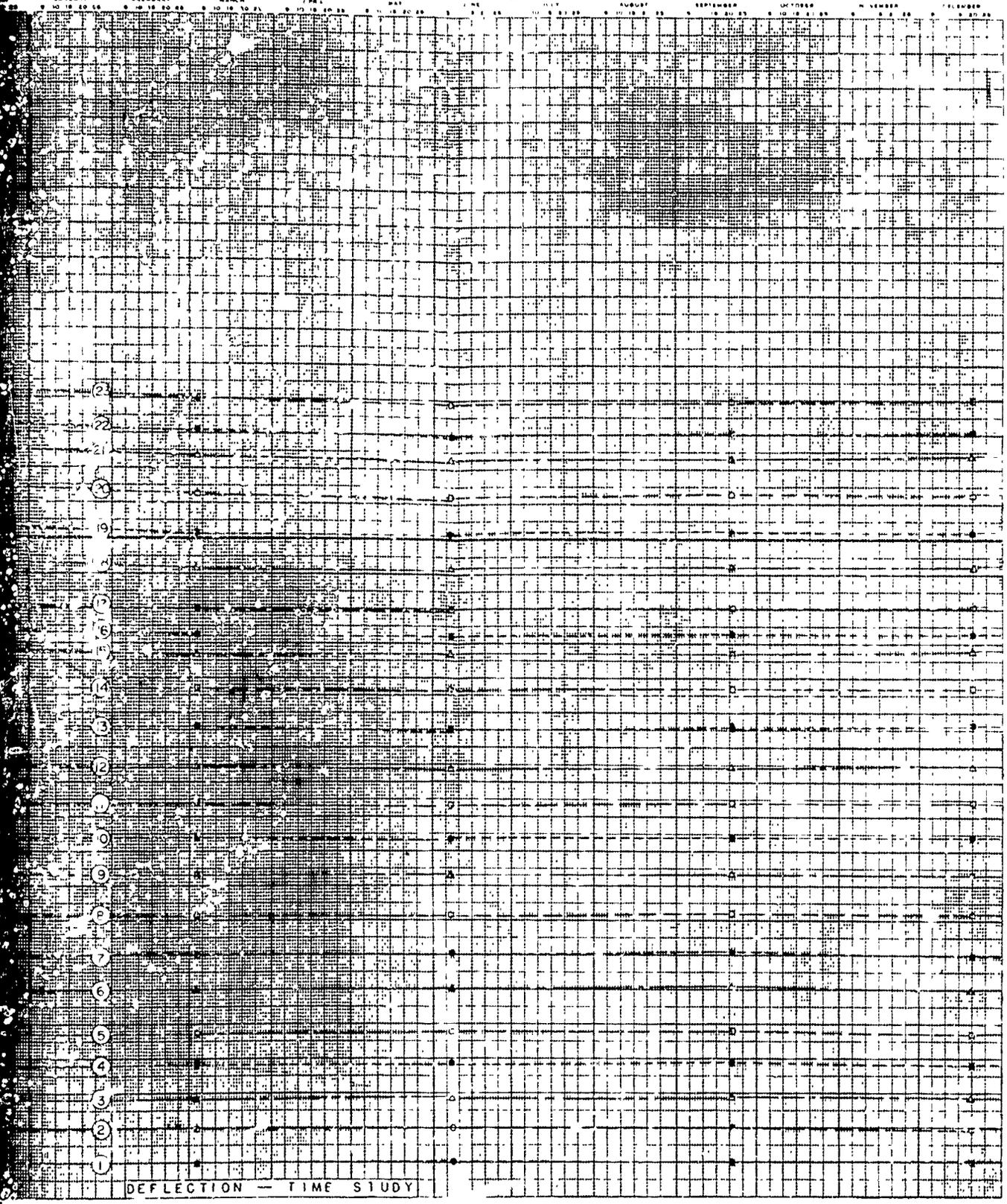


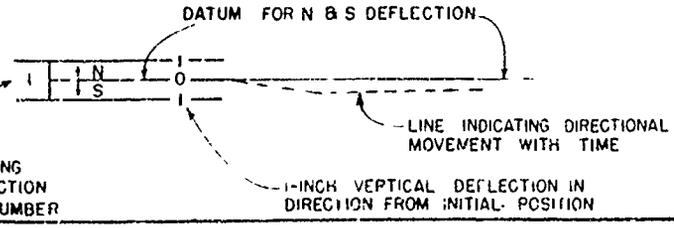
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA-N&S
VIF-98-5

PLATE 47


1971
El 673±
El 550±
CASING SECTION NUMBER
LEGEND
CASING SECTION NUMBE

1972

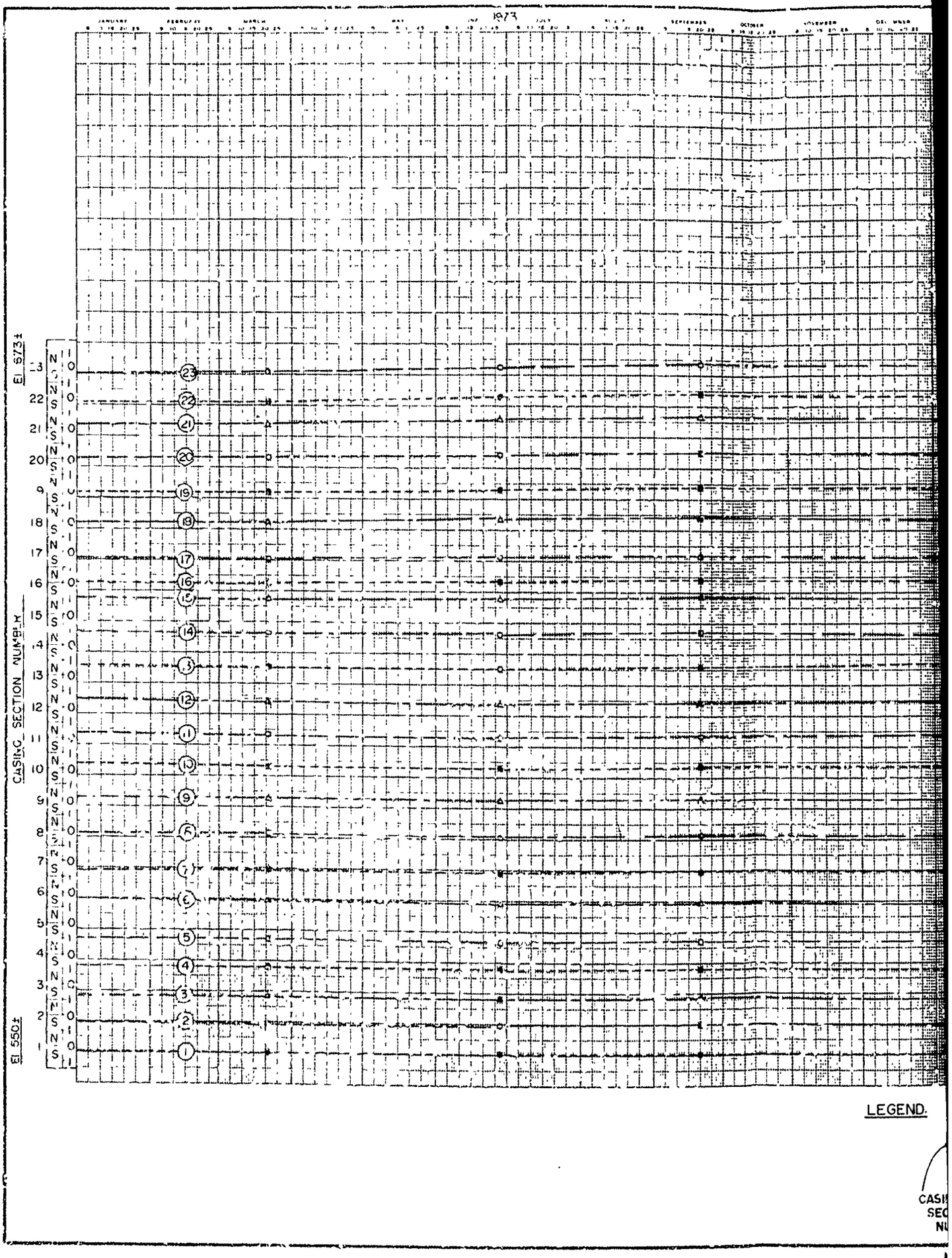




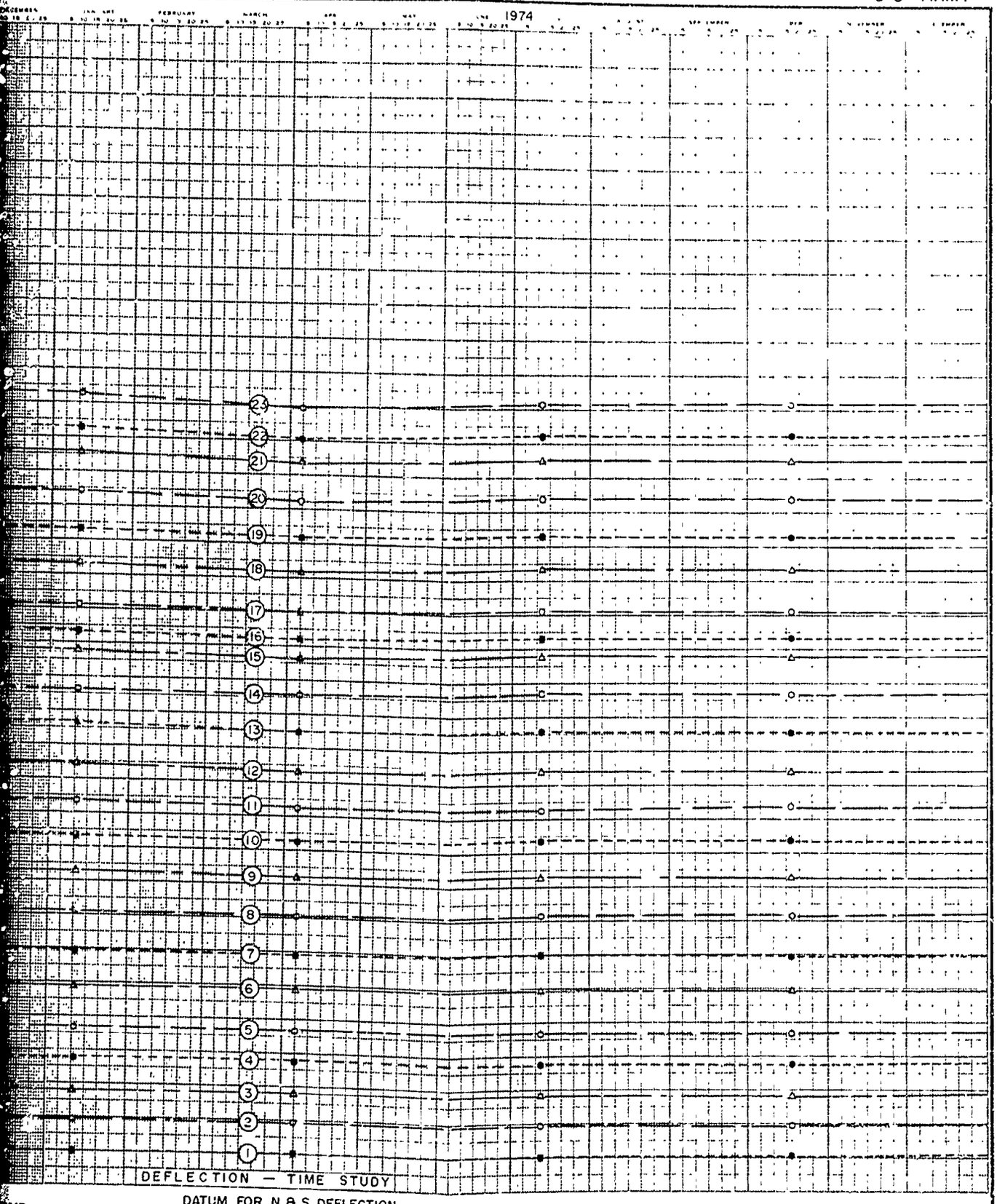
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA N & S
VIF-98-5

PLATE 48

CORPS OF ENGINEERS

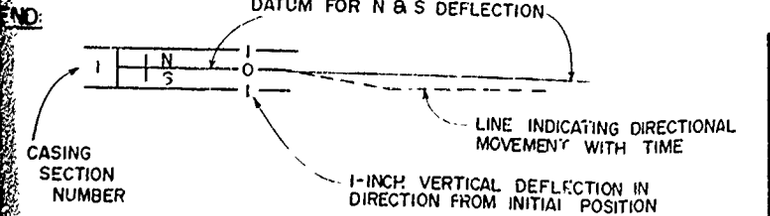


U S ARMY



DEFLECTION — TIME STUDY

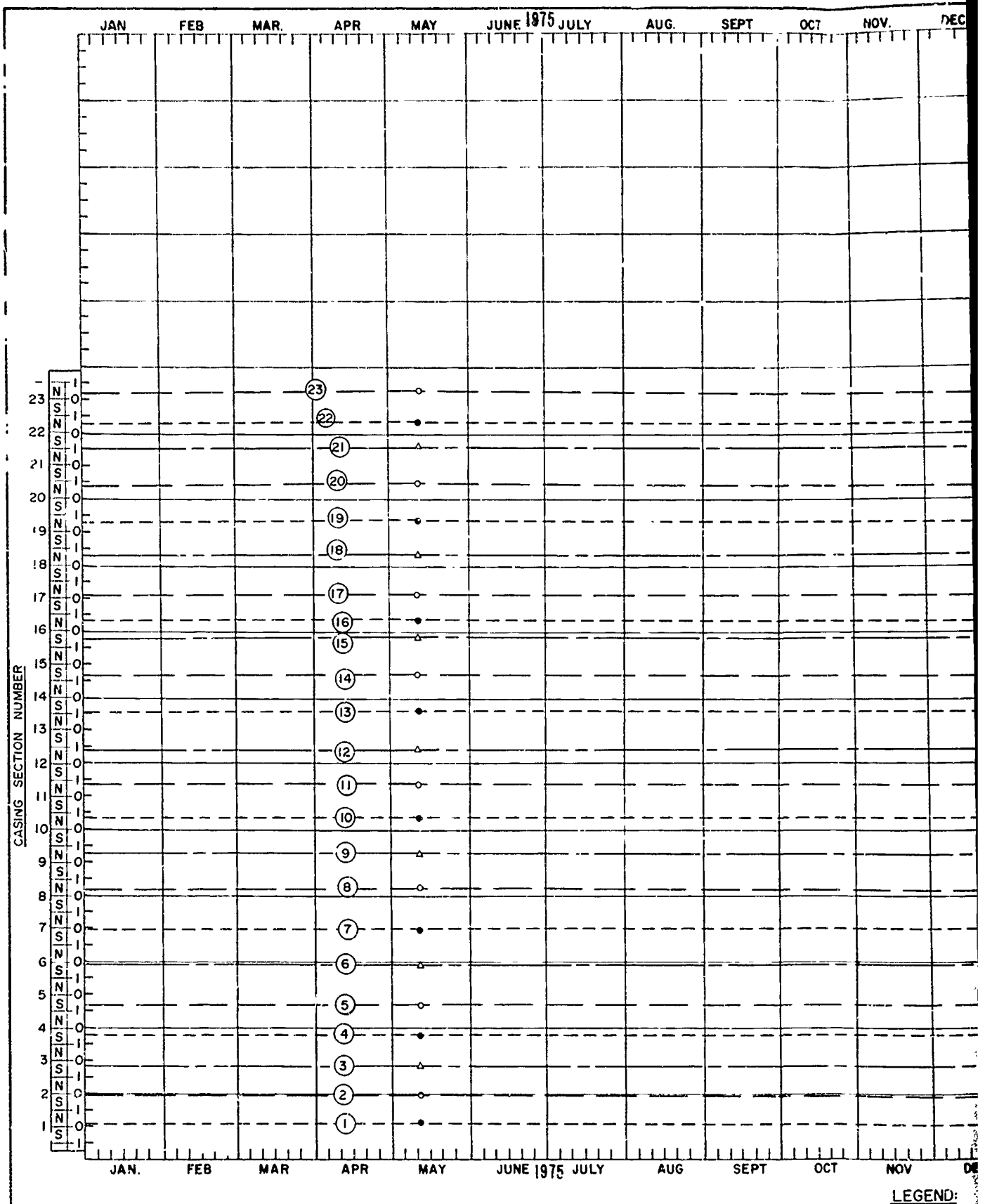
END:



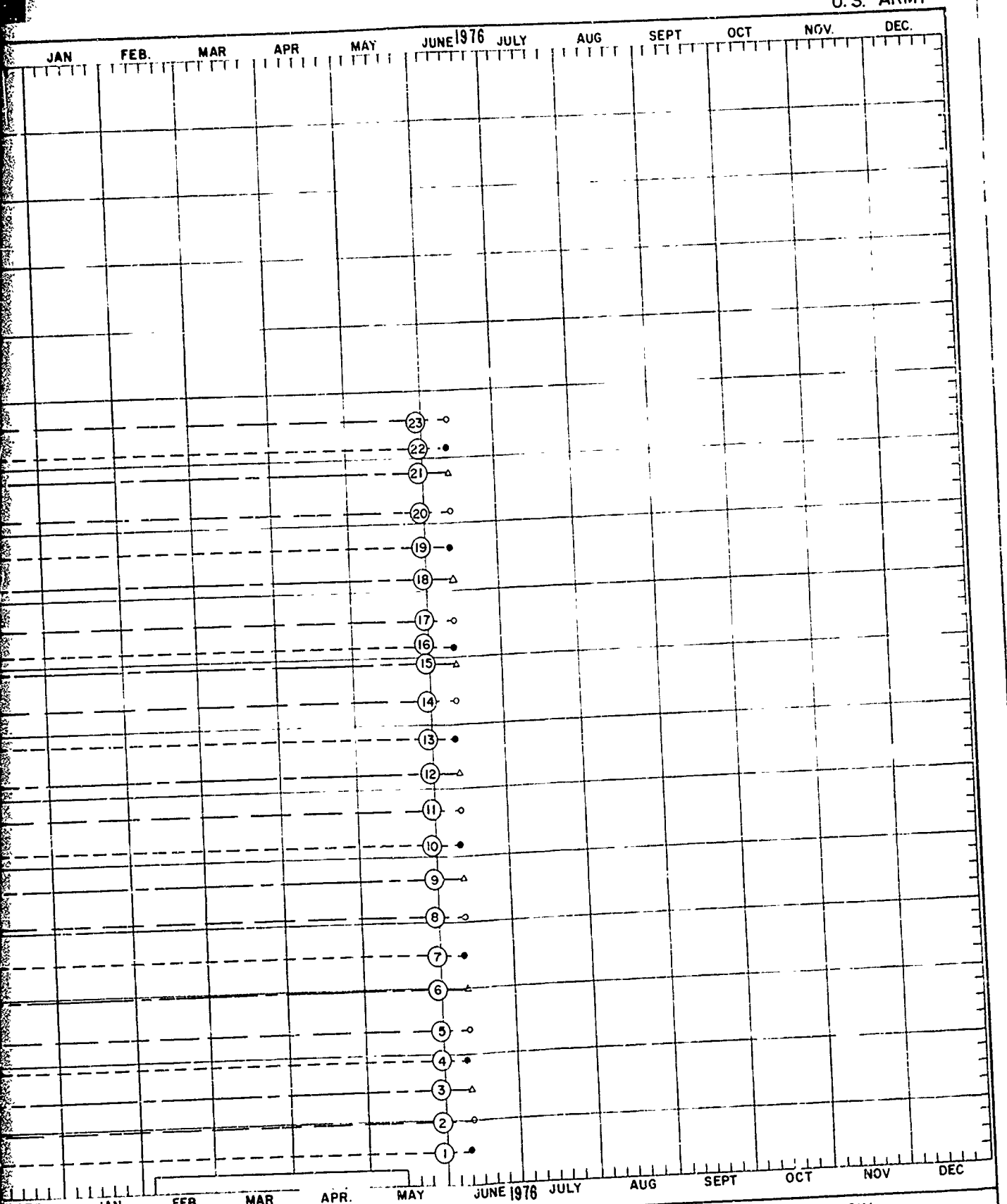
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA N & S
VIF-98-5

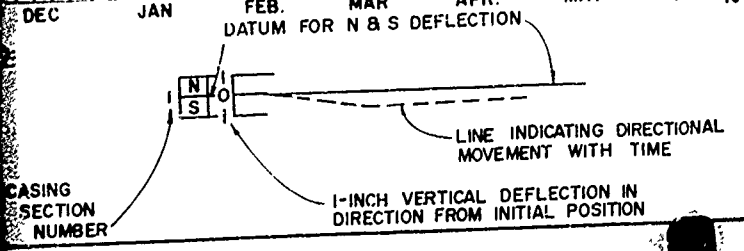
PLATE 49

CORPS OF ENGINEERS



U.S. ARMY



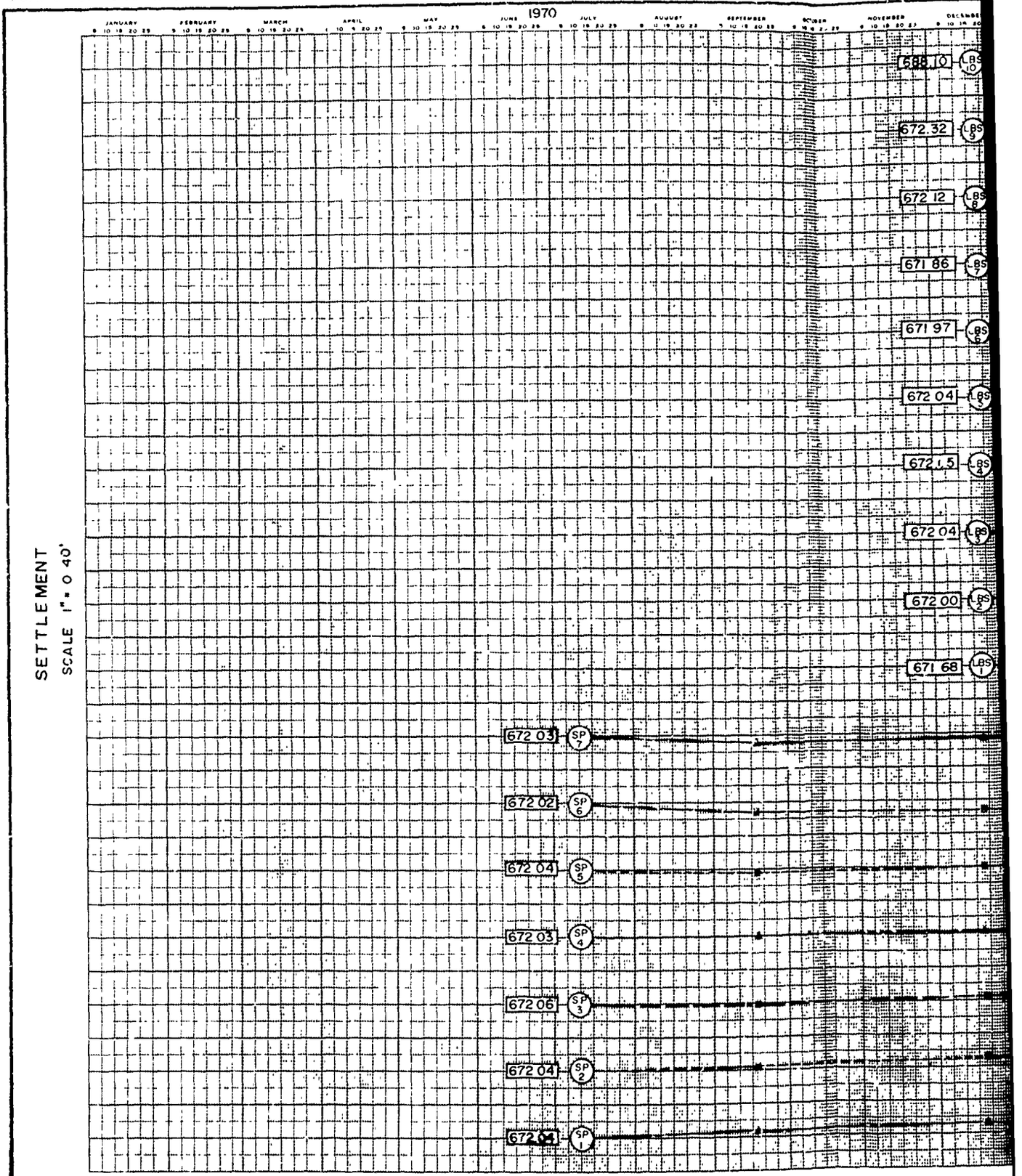


LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.

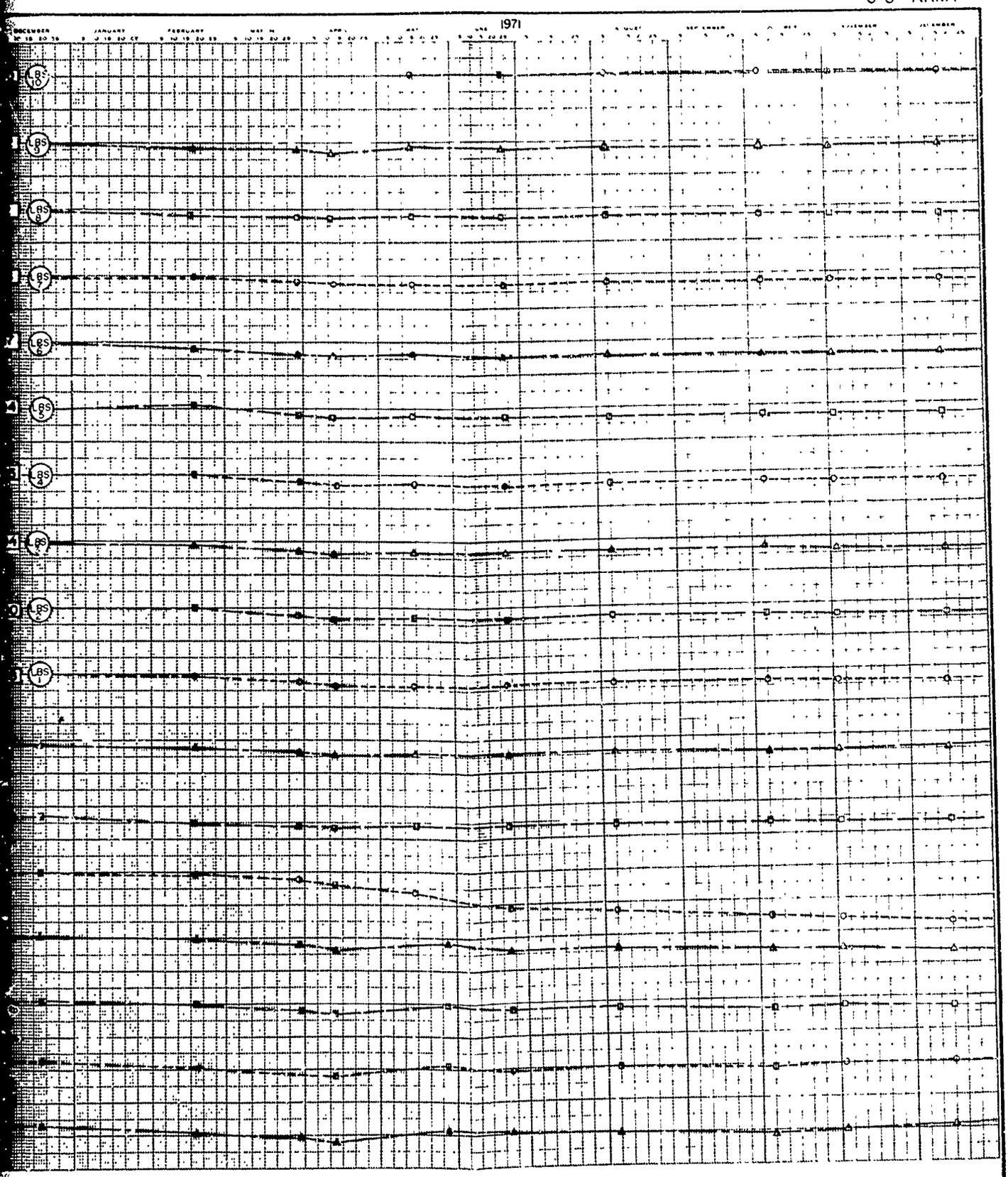
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA N&S
VIF 98-5

PLATE 50

CORPS OF ENGINEERS



U S ARMY



LEGEND

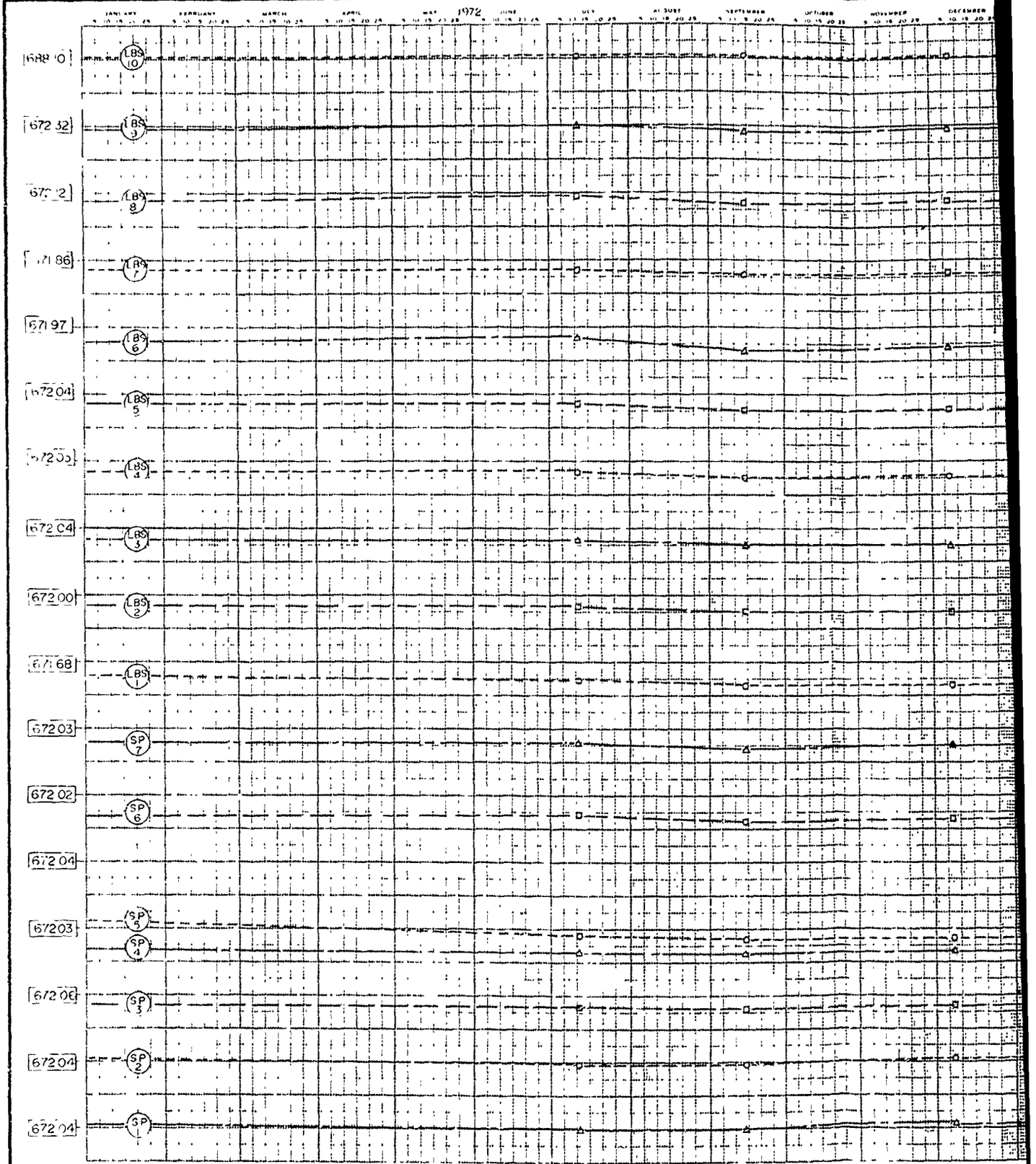
672.04 — INITIALLY INSTALLED ELEVATION

SP 1 — SURFACE SETTLEMENT PIPE NUMBER — INITIAL POSITION

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT PIPES
TOP OF DAM SETTLEMENT

PLATE 51

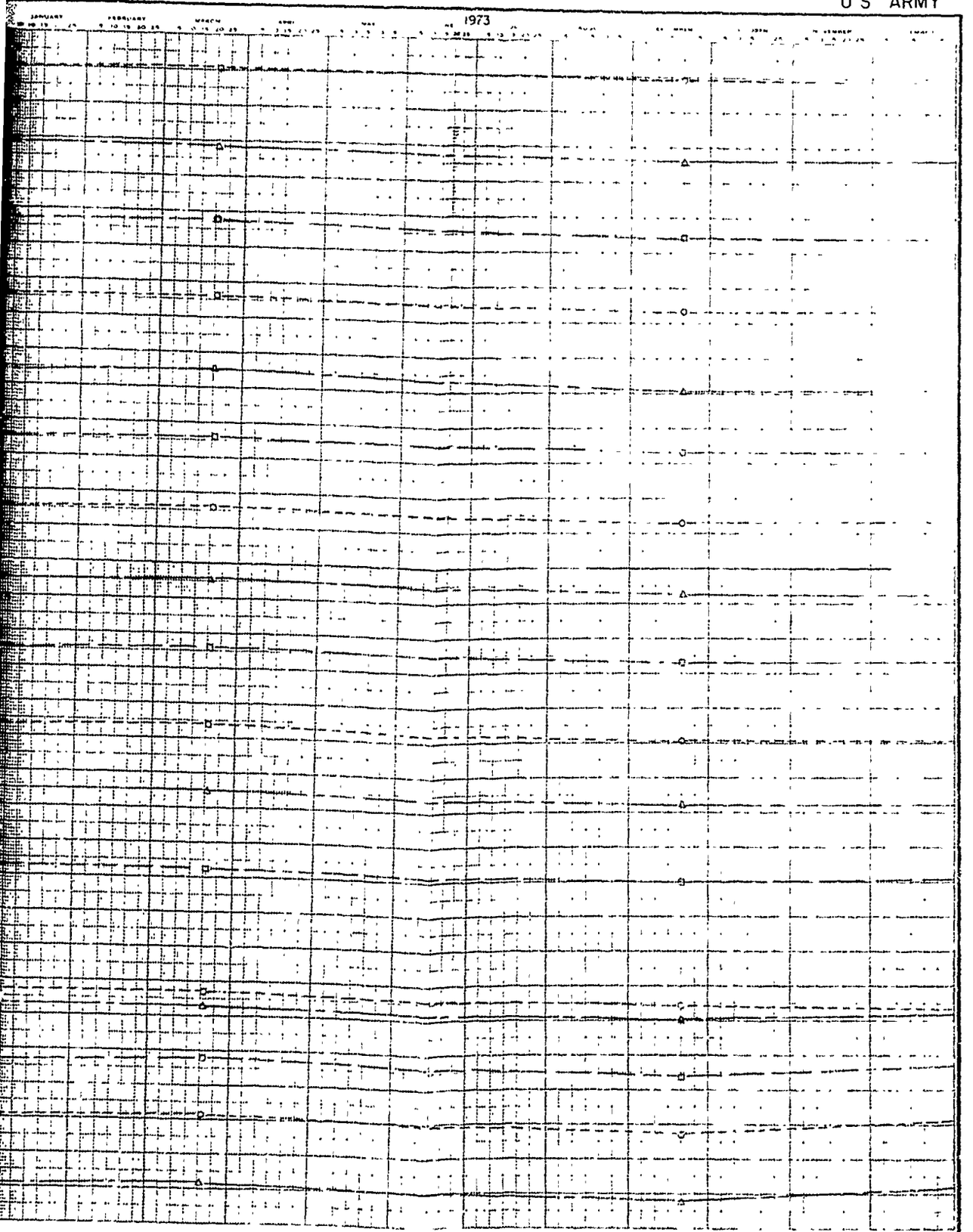
CORPS OF ENGINEERS



LEGEND:

INITIALLY INSTA
ELEVATION

U S ARMY



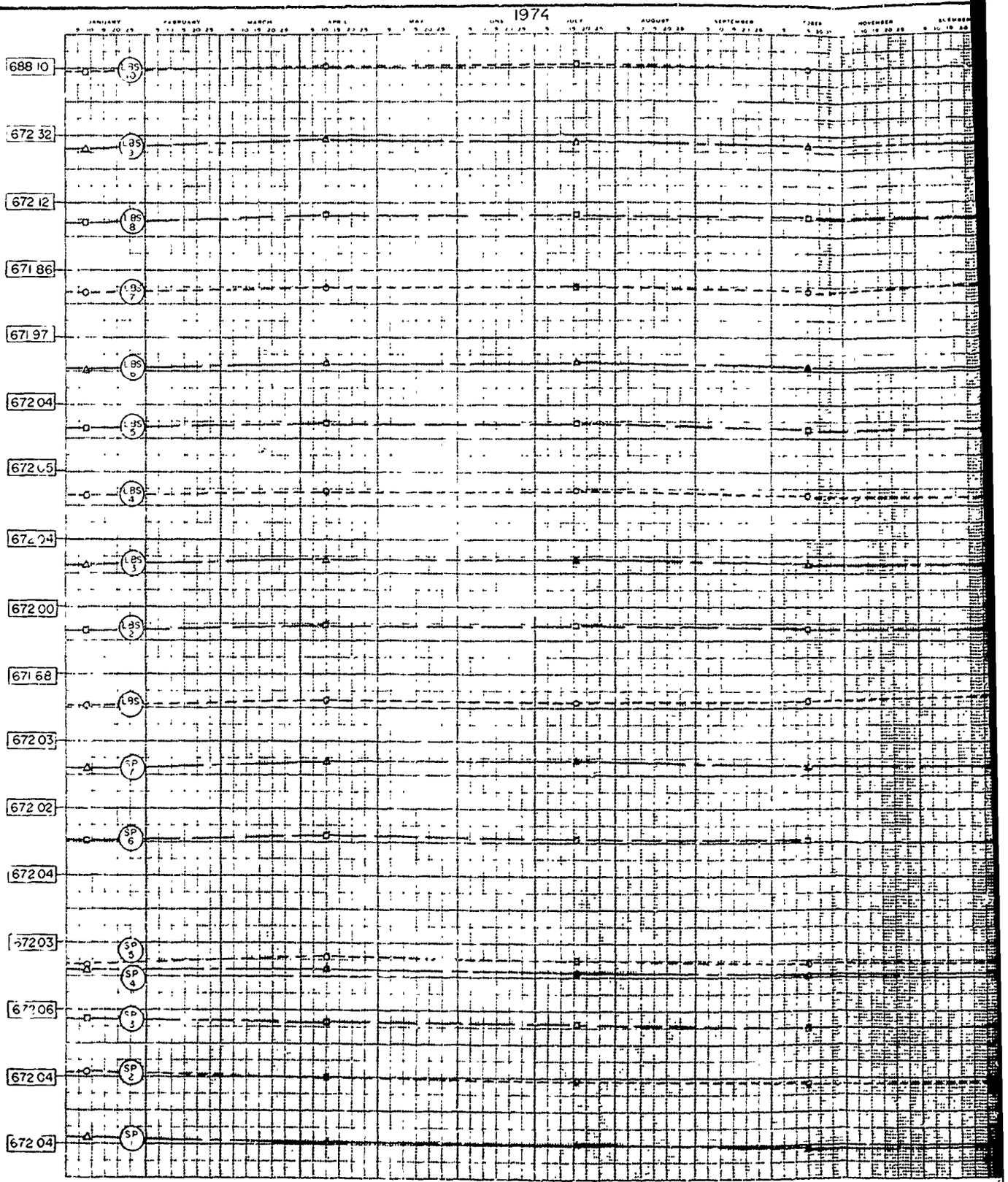
672 04 (SP 1)

SURFACE SETTLEMENT PIPE NUMBER

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT PIPES
TOP OF DAM SETTLEMENT

PLATE 52

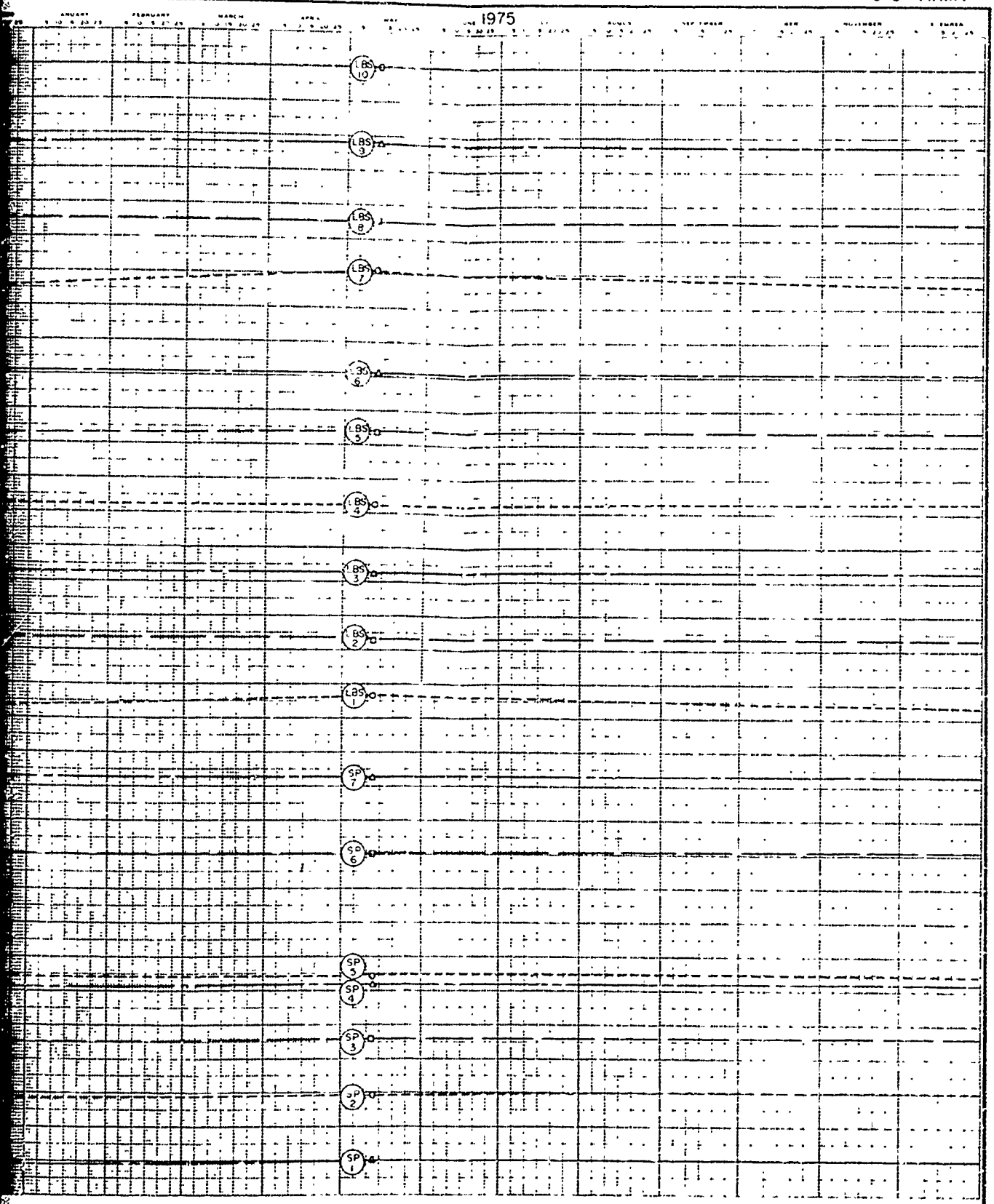
CORPS OF ENGINEERS



LEGEND:

INITIALLY
ELEVATION

U S ARMY



672 04 (SP 1)

INSTALLED

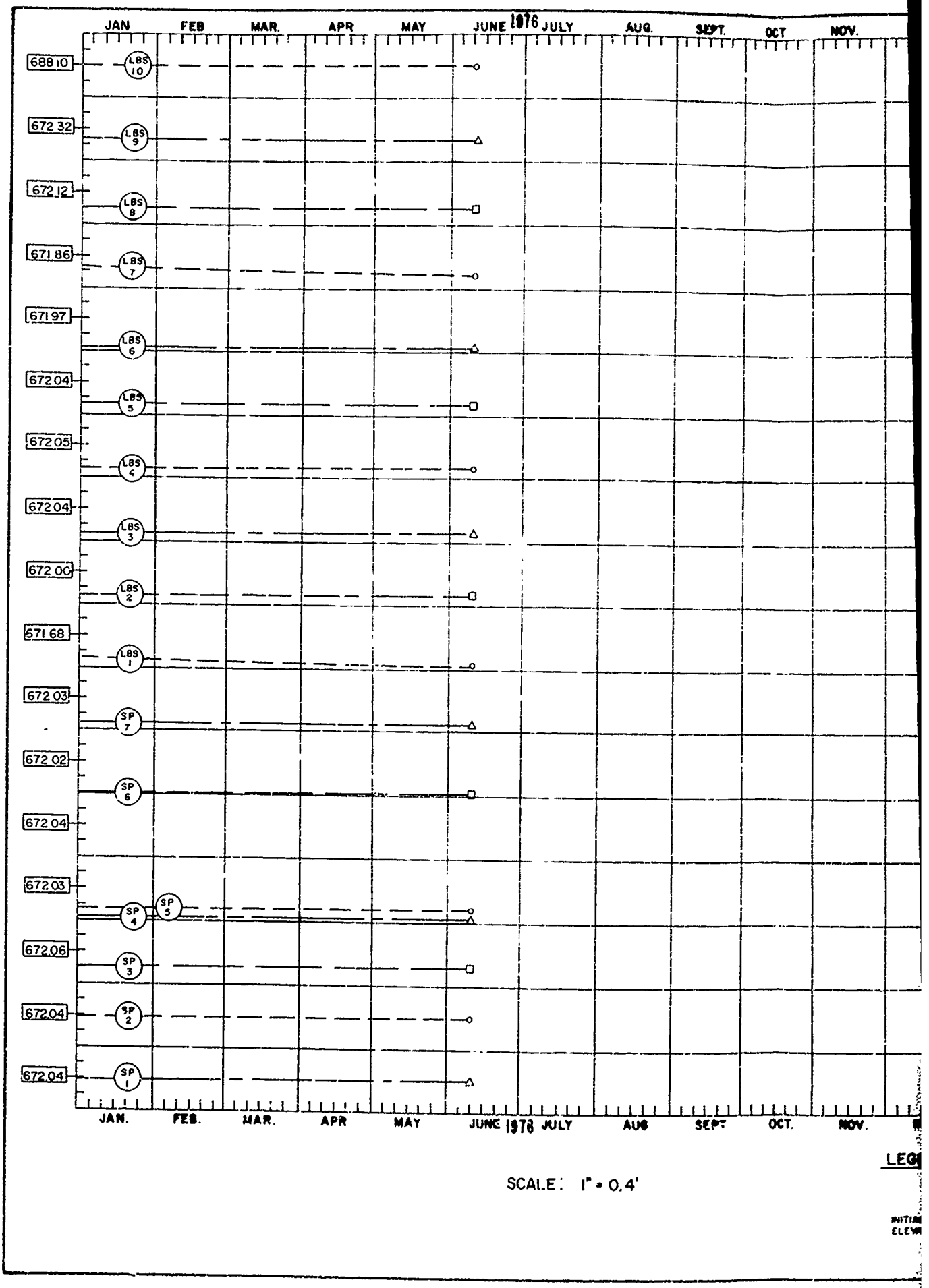
TION

SURFACE SETTLEMENT PIPE NUMBER

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT PIPES
TOP OF DAM SETTLEMENT

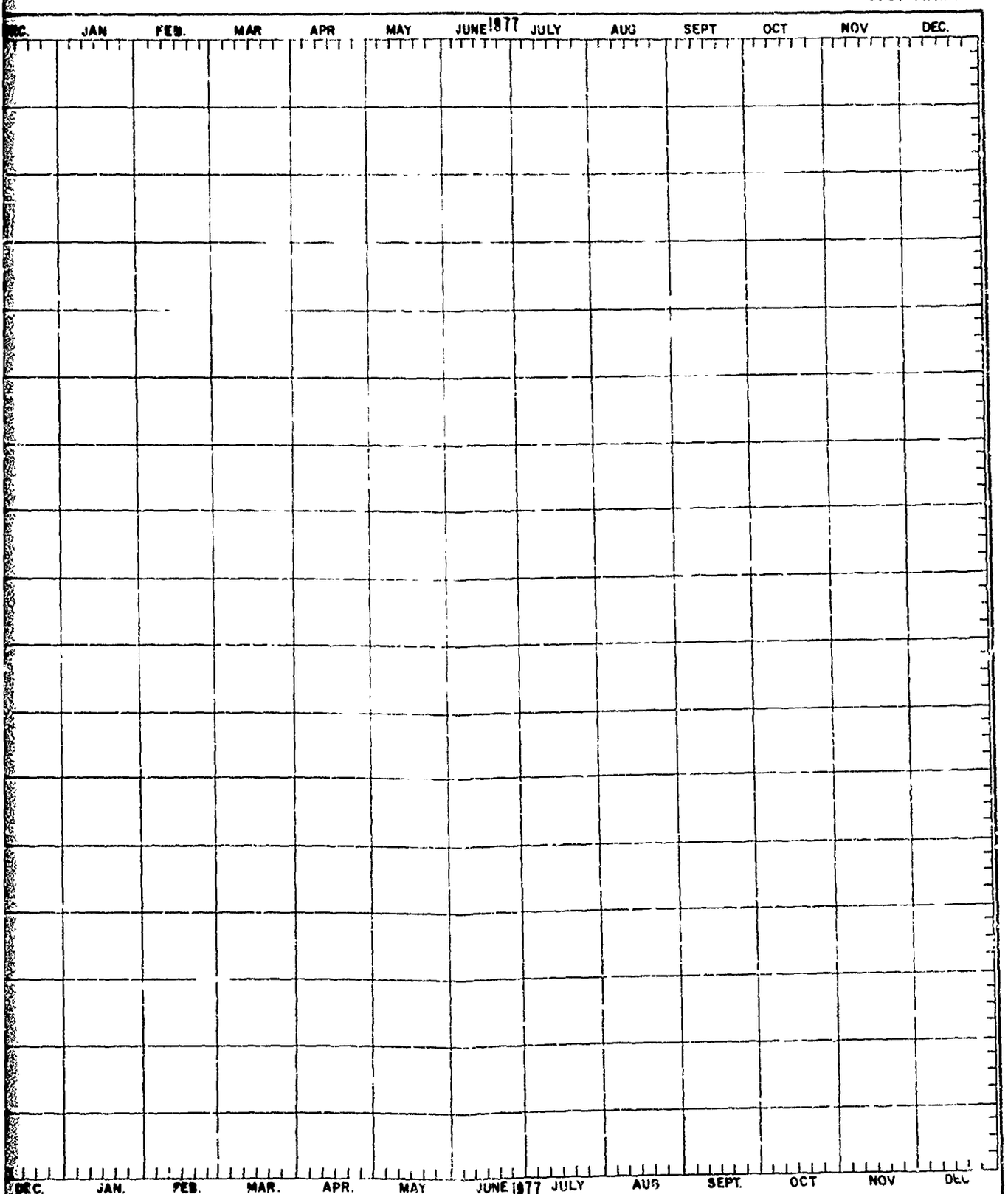
PLATE 53

CORPS OF ENGINEERS



SCALE: 1" = 0.4'

U.S. ARMY



LEGEND:

672.04 — INITIALLY INSTALLED ELEVATION

SP 1 — SURFACE SETTLEMENT PIPE NUMBER

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT PIPES
TOP OF DAM SETTLEMENT

PLATE 54

APPENDIX A

Condition Report
Beltzville Lake
Pohopoco Creek, Pennsylvania

Periodic Inspection Report No. 6

List of Attendees

BELTZVILLE LAKE

List of Attendees - Periodic Inspection No. 6.

T. J. Bevacqua	NAD, Engineering
A. Iarrobino	NAD, Engineering
G. Savage*	NAD, Construction
A. Fikstrems	NAD, Engineering
H. Rubright	NAP, Engineering Division
S. Fritzinger	NAP, Engineering Division
F. Peterson	NAP, Engineering Division
F. Braun	NAP, Engineering Division
D. K. Erickson*	NAP, Engineering Division
F. Schaefer'	NAP, Engineering Division
H. R. Spies*	NAP, Construction-Operations Div.
W. Werner'	NAP, Construction-Operations Div.
B. Uibel	NAP, Engineering Division
R. Smith	NAO
Major D. Means*	Northern Area Engineer
J. Borchick*	Head Dam Operator, Beltzville Lake

'Part Time

APPENDIX B

Condition Report
Beltzville Lake
Pohopoco Creek, Pennsylvania

Periodic Inspection Report No. 6.

Photographs

PHOTO 1 - Extracted from 1970 Report

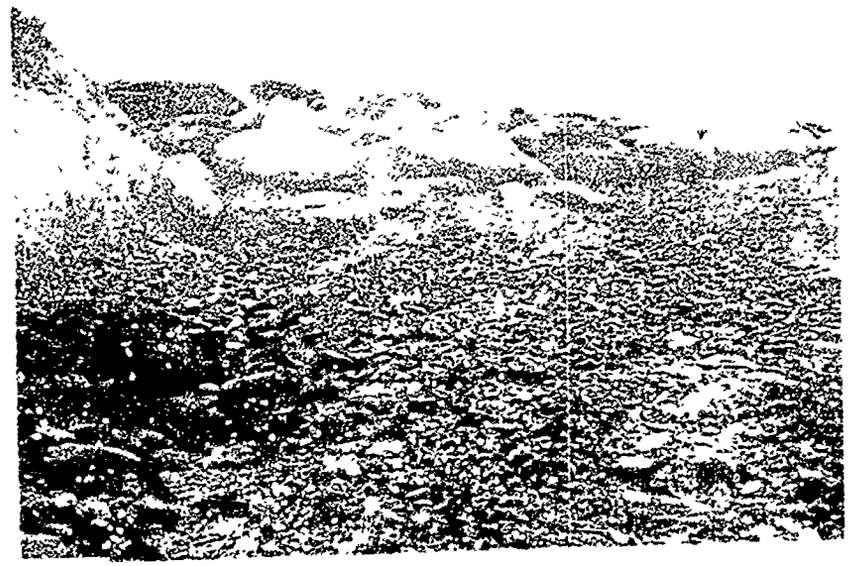


PHOTO 1A - Comparison photo taken Sep 1971

PHOTO 1B - Comparison photo taken Nov 1976

PHOTOS 1 to 1B - Comparison views of area between right abutment & embankment where large boulders were placed during construction to prevent erosion.

PHOTO 2 - Ditch looking towards stilling basin and large boulder pile shown in Photos 1 thru 1B (in left background). Note erosion - Nov 1976.

PHOTO 3 - Contact area between dam and downstream left abutment - Nov 1976

PHOTO 4 - Rock falls along right slope of spillway, upstream of spillway bridge - Nov 1976.

PHOTO 5 - Same as photo 4 from point further downstream - Nov 1976.

PHOTO 6 - [illegible]ls in right slope of spillway -

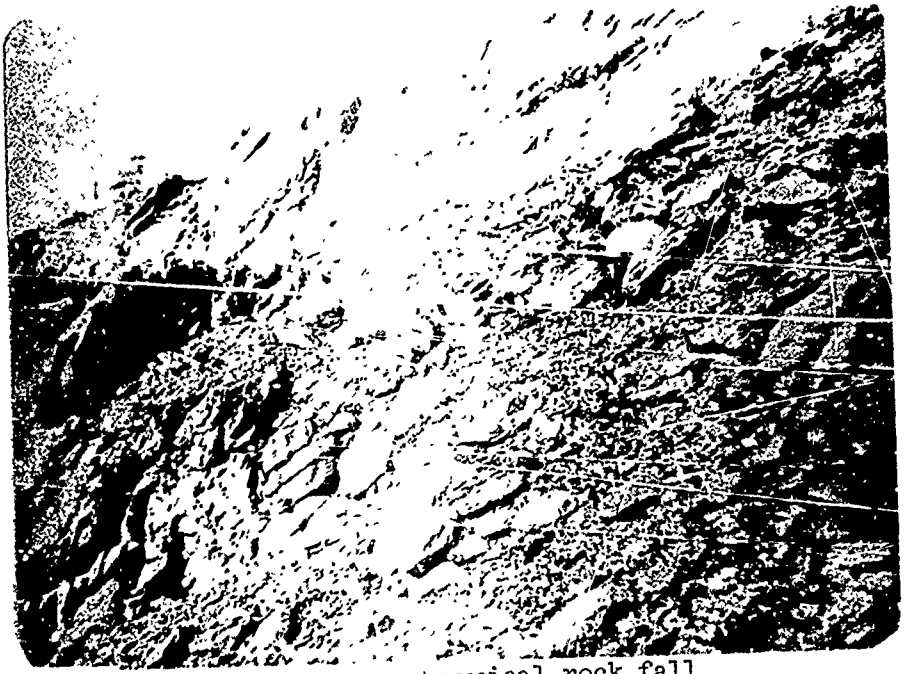
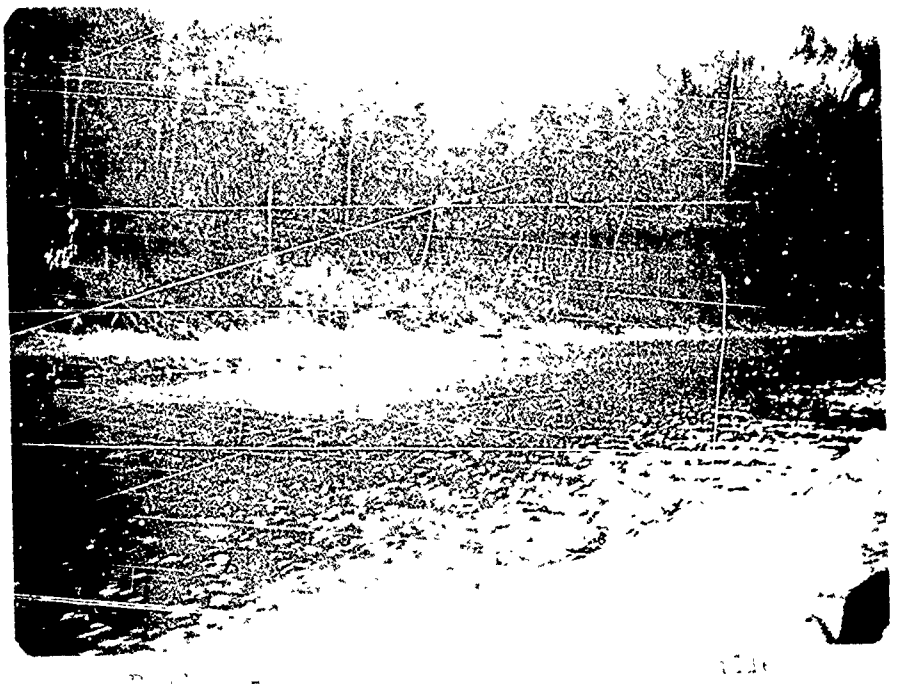
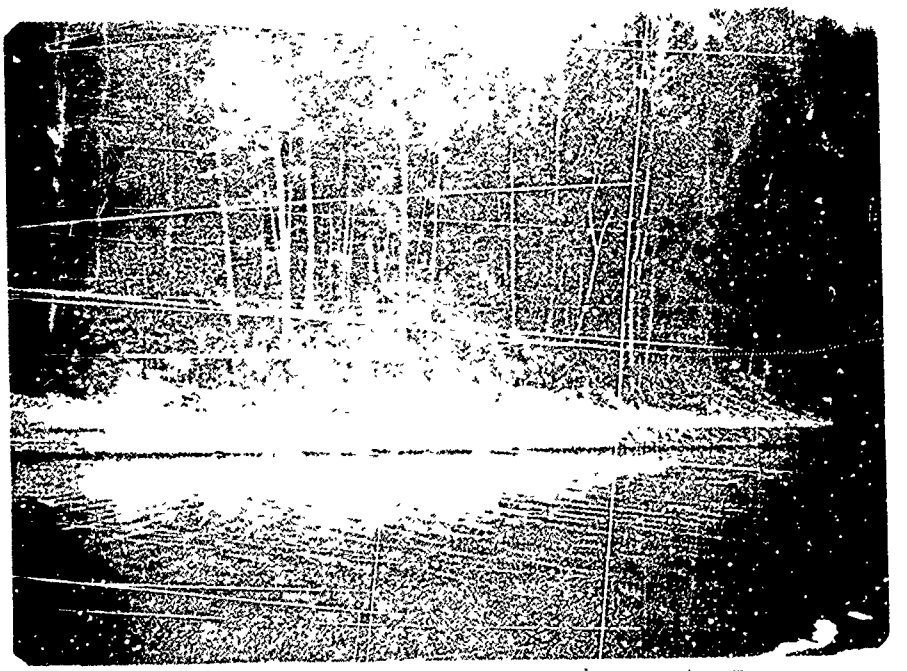


PHOTO 7 - Closeup [illegible]ypical rock fall along right slope [illegible] spillway - Nov 1976.





APPENDIX C

Condition Report
Beltzville Lake
Pohopoco Creek, Pennsylvania

Periodic Inspection Report No. 6

NADEN-TF/TS D.F. dated 14 December 1976. Subject, Beltzville Dam, Periodic Inspection.

NAPNA D.F. and Inclosure dated 24 February 1977. Subject, Periodic Inspection, Beltzville State Park Facilities, 12 Nov 76.

For use of this form, see AR 340-15; the proponent agency is TAGCEN.

DEPARTMENT OR OFFICE SYMBOL	SUBJECT
NADEN-TT/TS	Beltzville Dam, Periodic Inspection

TO Chief, Engr Div FROM Carrobino/Eikstrems DATE 14 Dec 76 CMT 1

The major items noted and discussed during the sixth periodic inspection of the subject project are as follows:

a. Instrumentation

(1) Currently the O & M manual makes reference to other documents relative to the instrumentation and consequently may lead to some confusion on the part of the operating personnel. The manual should be revised to include all operating, maintenance and reporting procedures and policies without reference to other documents.

(2) Numerous piezometers are not operable. This is precluding proper monitoring of the performance of the dam and should not be permitted to continue. Special O & M fundings should be requested promptly to insure replacement of piezometers by the Spring of 1977.

(3) Periodic Inspection Report #6 should include graphic plots of all instrumentation data cumulated to date.

(4) It is understood that piezometer readings are submitted from the field to the district office on a monthly basis and the weir data less frequently. Pressure and seepage are often interrelated and consequently both sets of data should be furnished concurrently on a monthly basis.

b. Intake Tower

(1) Numberous water seeps through the construction joints were observed; this condition is adversely affecting the electrical equipment and corroding some of the steel structural members within the tower. Consideration should be given to applying waterproofing material on the concrete interior, e.g. VANDEX. It is recommended that a test section with some sort of interior waterproofer be constructed promptly and observed for effectiveness.

c. Intake Tower Access Bridge

Minor new cracks were noted on the top of the access bridge piers. They do not affect the adequacy of the structure at present but should be monitored in future inspections.

d. Outlet Works - Conduit

(a) The extensive cracking in the concrete conduit showed little change from

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SUBJECT: Beltsville Dam, Periodic Inspection

that charted in the previous inspection. Future inspections should continue to monitor cracking in the conduit.

(b) The water quality gate had noticeable leakage when in the closed position. This condition has been noted in previous inspections.

e. Spillway

Cracking in the spillway slab and displacement of expansion joint material between spillway slab and bridge pier showed no change from that noted in the previous inspection and no action is required at this time.

ARROBINO ENGINEERS

DISPOSITION FORM

For use of this form, see AR 340-15, the proponent agency is TAGCEN.

REFERENCE OR OFFICE SYMBOL	SUBJECT
NAPNA	Periodic Inspection, Beltzville State Park Facilities, 12 Nov 76

TO Ch, F & M Br.
ATTN: B. Uibel

FROM Northern Area Engineer

DATE 24 Feb 77

CMT 1

MAJ MEANS/cs/377-0438

1. Reference NAPNA letter to Mr. Lupino, Beltzville State Park Superintendent, dated 4 Feb 77. (Copy sent to F & M Br.)

2. Attached as Inclosure 1 is a copy of Mr. Lupino's reply to the above referenced letter. I have reviewed the deficiencies and corrective actions taken/to be taken. I feel Mr. Lupino will be aggressive in following up on these items, but in certain cases, funding may cause some delays.

1 Incl
as

DALE F. MEANS
Major, Corps of Engineers
Northern Area Engineer

DA FORM 1 FEB 62 2496 REPLACES DD FORM 96, WHICH IS OBSOLETE.

☆GPO—1975—665-422/1063

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF ENVIRONMENTAL RESOURCES

BELTZVILLE STATE PARK
R. D. #3, BOX #252
LEHIGHTON, PA 18235

February 8, 1977

Major Dale F. Means
Department of the Army
Philadelphia District
Corps of Engineers
Northern Area Office
R. D. #4, Box #147
Lehighton, PA 18235

Dear Major Means:

The following is the proposed action that will be taken by Beltzville State Park's personnel to correct the subject deficiencies:

SEWAGE TREATMENT PLANT

a. The exposed equipment will be repainted as scheduling permits, prior or during this season's operation.

b. A flow meter has been requested for purchase.

c. The float switch is currently being repaired and when reinstalled, the flexible conduit will be replaced along with proper connections by a certified electrician.

RECREATION AREA

a. Water Tank and Pump House.

1. Appropriations will be requested through this year's 400 Allocation Request.

2. The rust spots on the water tank will be removed and painted with the appropriate paint prior to filling the tank for the 1977 season.

3. The altitude valve has been bypassed and the well pumps are turned on and off manually. The altitude valve is not dependable and the manual operation of the tower is the best assurance of an ample water supply to the facility.

4. Painting of the water tower will be submitted on the 1977 400 Appropriation Request.

b. Covered Bridge.

1. Materials for the repair of the roof have been purchased and a contract to install the roof is currently underway.

c. Change House.

1. Half of the change house toilet facilities have been blocked off to save water and personnel in cleaning the facility. There have been no inconveniences to the using public from the reduction of toilets and no resulting damage to the blocked-off section of the building.

2. Repairs and replacement of the change house roof have been completed.

3. Lights and shades have been purchased and will be installed prior to the building's opening this season.

4. Paint is being purchased for the exterior stalls. The stalls will be repainted as work scheduling permits.

5. Stack sections and wind shields on the oil-fired hot water tanks have been purchased and will be installed prior to opening the building this season.

d. Lifeguard station.

1. The exhaust fan will be repaired or replaced prior to the use of the building.

e. Picnic Area.

1. The sink plumbing fixtures in the comfort station will be cleaned of all rust and replacements purchased as appropriations become available.

Sincerely yours,

Anthony J. Lupino, Jr.
Park Superintendent

AJL:rgs